TRANSACTIONS

OF THE

Odontological Society of Great Britain.

VOL. IV.—NEW SERIES.

TRANSACTIONS

OF THE

ODONTOLOGICAL SOCIETY

OF

GREAT BRITAIN.

VOLUME IV.—NEW SERIES.

LONDON:
Printed and Published for the Society by
WYMAN & SONS, 74–5, GREAT QUEEN STREET,
LINCOLN'S-INN FIELDS, W.C.
1872.

List of Officers.

President.

THOMAS UNDERWOOD, ESQ.

Vice-Presidents.

RESIDENT.	NON-RESIDENT.
ALFRED CANTON, ESQ.	JOSEPH SNAPE, ESQ. (Liverpool).
ISAAC SHEFFIELD, ESQ.	JOHN A. BAKER, ESQ. (Dublin).
EDWIN SERCOMBE, ESQ.	PETER ORPHOOT, ESQ. (Edinb.)

Treasurer.

W. A. HARRISON, ESQ.

Librarian.

THOMAS A. ROGERS, ESQ.

Honorary Secretaries.

G. GREGSON, ESQ. (Council).
T. HENRY G. HARDING, ESQ. (Society).

FOR FOREIGN CORRESPONDENCE.

CHARLES JAMES FOX, ESQ.

Councillors.

RESIDENT.	NON-RESIDENT.
JOHN TOMES, ESQ., F.R.S.	H. B. RODWAY, ESQ. (Torquay).
SAMUEL CARTWRIGHT, ESQ.	S. C. GIBBONS, ESQ. (Brighton).
G. A. IBBETSON, ESQ.	G. S. WILLIAMS, ESQ. (Clifton).
W. F. FORSYTH, ESQ.	J. H. MARTIN, ESQ. (Portsmouth).
ROBERT RAMSAY, ESQ.	J. K. CHISHOLM, ESQ. (Edinburgh).
E. H. KING, ESQ.	D. CORBETT, ESQ. (Dublin).
JAMES PARKINSON, ESQ.	
JOSEPH ROGERS, ESQ.	
E. J. WINTERBOTTOM, ESQ.	

GENERAL MONTHLY MEETING,

Monday, November 6, 1871.

J. R. MUMMERY, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentlemen were admitted Members of the Society :—

Mr. Franklin Henry,
Mr. G. R. Keeling, Epsom.

The following gentlemen were duly elected Members of the Society :—

Mr. Duncan Amsore, Hastings.
Mr. Blandy, Nottingham.
Mr. William Hunt, Yeovil.
Dr. Bogue, New York, was proposed a Member.

Presentations to the Museum.—Jaws of Myliobates, by Mr. King; Skull of a Camel, by Mr. Scully.

Presentations to the Library.—The Proceedings of the Philosophical Society of Glasgow; the German Quarterly Journal of Dental Surgery; the "Cosmos."

The President said it gave him great pleasure to welcome the members after the recess, and he sincerely hoped that they had all been benefitted by their much-needed holidays. He believed that no set of professional men more thoroughly needed periodical recreation, working as they did in an atmosphere not

always the most exhilarating. Since they last met no tidings had been received of the death of any member, and he hoped that none had to lament the occurrence of domestic calamity. He trusted that the harmony, courtesy, and desire for mutual edification that had existed for many years would continue to be manifested.

Mr. Harrison said that he had been requested by Mr. Brookhouse, of Manchester, to bring under the notice of the Society the model which he now held in his hand. Before proceeding to describe the model, he would read Mr. Brookhouse's letter relating to it. It was as follows:—"In forwarding my subscription to the Odontological Society, I take the opportunity of sending the model of a little patient's mouth, to which, if you think well, you will kindly call the attention of the members at the next meeting. The model explains itself. The little girl is five years and two months old; and I expect to be able to watch the case as desired. I am, &c. &c." Now, on examining the model, it would be seen that it was one of the upper jaw of a child, having on the right side a supernumerary well-formed lateral incisor, slightly twisted on its axis, but otherwise well placed in the arch of the jaw. That was the only peculiarity in the case. What Mr. Brookhouse meant to do in the way of treatment he did not say; and whether he meant to do anything, except watching it to its natural termination at the period of the eruption of the second set, he (Mr. Harrison) had no means, from his letter, of forming an opinion. Considering the treatment to be adopted in such cases, however, one of great practical interest, he would take this opportunity of stating to the Society what had been his own practice in similar cases, and the result (so far as he had been able to trace results), in hope of eliciting opinions upon the subject which might be useful to the profession at large, and possibly to Mr. Brookhouse in the treatment of this case. So far as he remembered, he had met with three such cases—at any rate he had three such distinctly registered in his memory,—and in each of these cases he had, after taking a model of the mouth, immediately extracted the supernumerary lateral incisors, although they were neither producing any marked disfigurement, or any

inconvenience, under the supposition that, if left, they might possibly (if, indeed, they would not probaby) cause the permanent central incisors, during their formation, and at their eruption, to be thrown to one side of the mesial line. In two out of these three cases he had had the opportunity of seeing the patients after they were grown up, and the result (or apparent result) had been most satisfactory, for the permanent centrals had taken excellent positions. The third he had lost sight of. Now, he was quite aware that it might be said that this practice was founded upon purely theoretical grounds, and that the results might have been the same in the two cases he had related, whether these temporary supernumerary laterals had been taken out or not; but, in defence of the practice, he would say that it was founded on physiological reasoning. On these points he would be glad to hear the opinion of the Society; and if any members present had had opportunities of treating such cases, and seeing the result of their treatment, he would be exceedingly glad to hear what their treatment and its result had been. Before sitting down, he might add that all the patients he had alluded to were very young—somewhere about three years of age each—when he removed the teeth, which he thought an important point in connection with the practice, if there were any good physiological grounds for it.

Mr. Coleman had seen a larger number of cases than that named by Mr. Harrison; he was certain he had seen at least six. It was his impression that in the majority of them the occurrence was upon the right side of the mouth. He had not adopted the course pursued by Mr. Harrison, because he had not witnessed any deviation of the central incisors from their normal position, there had been no encroachment upon the mesial line upon that side when the plurality existed, and therefore he had not seen it necessary to inflict any painful operation upon the cases brought to him. Had he deemed such a course necessary, he would have experienced a difficulty in selecting the supernumerary member, for in all the cases he had met with it was a well-formed tooth, and not like the supernumerary teeth commonly met with in the permanent series. He hoped to be able to bring before them two or three casts of

such cases at their next meeting. He confessed he had not had the opportunity of seeing the condition of the permanent series where this irregularity had existed in the temporary series.

Mr. Harrison said that he was much obliged to Mr. Coleman for his remarks, although they went to oppose his theory. The cases quoted by Mr. Coleman, however, would not settle the question he had raised, inasmuch as they had not yet passed the period of the second dentition, and it was to the *results* following different modes of practice that they must look for settling that question. He hoped Mr. Coleman would have the opportunity of watching, and of hereafter communicating to the Society the results in some of the cases he had alluded to.

The President thought it most desirable that gentlemen who met with examples of these abnormal conditions should more frequently bring them under the notice of the Society. The very fact that Mr. Harrison and Mr. Coleman, whose opinions were both highly esteemed, should hold such adverse views on the subject before them showed how important it was that such points should be most freely discussed. They all met with cases in their practice bearing on this subject, and he thought a collection of models exhibiting such facts would be a most interesting and valuable addition to the museum of the Society.

Mr. Fox said that a few days ago a gentleman had applied to him for the extraction of a lower wisdom-tooth, the crown of which was so deeply embedded beneath the crown of the second molar, that after long endeavours to remove it with the elevator and forceps, it was deemed necessary to remove the second molar. On the patient mentioning his case to a medical friend, Dr. W. T. Jones, of Holloway, that gentleman comforted him by showing him two very excellent osseous preparations illustrating his case, and sent them to show him (Mr. F.), who at once coveted them for the museum; in one case the embedded lower wisdom was placed very much lower against the second molar roots than even in the case depicted in Tomes'

"Manual of Dental Surgery." The specimens were prepared by Mr. Marant, a clever osteologist and dentist to Charles X., who gave it to Dr. Jones, and that gentleman, hearing of the Society's museum, had generously presented the specimen to them.

The President considered it the most remarkable case he had ever seen, as the tooth stood at fully a right angle with the normal position.

Mr. Sercombe had seen a similar case to the one exhibited by Mr. Fox, in the collection of the late Mr. Nasmyth, of Edinburgh. It terminated fatally; a post-mortem examination revealed the cause of the severe sufferings the patient had endured to be a malplaced wisdom-tooth. He had the notes of the case, written by Mr. Nasmyth, in his possession, together with a drawing of the lower jaw.

The President.—At what age did the patient die?

Mr. Sercombe believed the age was stated in the narrative written by Mr. Nasmyth, but he could not answer the President's inquiry from memory.

Mr. Gregson wished to present the model of a young girl's mouth, showing two supernumerary teeth very awkwardly placed. The girl was sixteen. About a year ago she said she had two central teeth extracted, which were replaced by the present, and the dentist then declined to extract them. However, she came to the Hospital on Wednesday last, and the teeth were then extracted. She also said she had two canine teeth immediately above her present canine teeth extracted twelve months before; and she also said that at thirteen years of age she had two central teeth extracted; thus showing a repetition of central teeth. Her recollection of her case seemed rather indistinct, and she could not be quite relied upon. The teeth seemed very strong, and firmly attached by the roots. As a rule, however, such teeth had generally short, stumpy, and awkward roots.

Mr. Browning exhibited a right-angle drill, which could be worked with one hand. It could be seen at Mr. Collins's shop.

Dr. Langdon Down then read the following paper :—

On the Relation of the Teeth and Mouth to Mental Development. By Dr. Langdon Down, Physician of London Hospital, late Resident Physician of Earlswood Asylum, &c.

Gentlemen,—

When your President did me the honour of requesting me to read a paper before your Society, I felt at first some reluctance, from the consciousness that one of a very practical character was not within the scope of my power.

It occurred to me, however, that there was a branch of inquiry on which I felt considerable interest, and which had some slight bearing on the department of medical science represented by this Society. I thought, moreover, that I should derive great gain myself in bringing my observations before you, from the fact that while some of my work has been with a somewhat special class of humanity, you would be able to correct or confirm my views from observations over a wider and more varied field. It is thus, by the comparison of results obtained from opposite stand-points, that broad principles may be elicited, where otherwise narrow, and possibly mistaken, views might be entertained.

At an early period of my study of the mental affections of childhood and youth, I became convinced that the question involved a far larger region of inquiry than the mere psychological phenomena which were presented before me,—that, interesting as were the examples of mental deviations which were the every-day object of one's contemplations, they were really only a part of the great subject; and one became convinced, from observation, that the physical deviations were as interesting and important as the psychical, in relation to the study of mental alienation, and especially to that form of it which had a congenital origin or proclivity. It became clear to me that idiocy and imbecility were not simply disturbances of brain-power,—were not simply nerve-lesions in the narrowed acceptation of the term,—but were profound diseases involving almost every organ and system of organs in the body. True, the encephalic ganglia were found altered, either in quality or quantity, or both; the convolutions of the brain might be reduced to quadrumanous simplicity in one case, or present remarkable symmetricality in another; but these were conditions that could only be ascertained on post-mortem inspection. The question that presented itself to me was,—Were there any outward and visible signs of inward mental disturbance? If idiocy were something more than brain alteration, it followed that an inquiry into

the condition of the other organs might establish some correlative change in them. With this object in view, I made a careful investigation into the bodily condition of nearly a thousand feeble-minded youth—their height, weight, and bodily conformation; into the condition of their muscular development, the state of their eyes, the shape of their ears; and last, but not least, into the structure of their mouths and the contents of the oral cavity. It was in my inquiry into the condition of the teeth and mouth especially that I arrived at the conclusion that, in by far the larger number of instances, I was able to indicate the period at which the depressed condition commenced, and to predicate in some degree the amount of improvement which physical, intellectual, and moral training might possibly effect.

Thus an examination of the mouth afforded me a valuable guide both as to diagnosis and prognosis in cases which, without such guide, would be frequently surrounded with insurmountable difficulty.

In consultations one is often pressed by the friends of the patient for an opinion as to the date at which the affection commenced. It is always a relief if an opinion can be given that the child was born intelligent; that the calamity is the result of some after-birth catastrophe. Curiously enough, there is often a degree of

wounded pride if it is decided that the child was defective from birth. It is by an appeal to the physical conformation only that the decision can be made. In children whose idiocy is accidental, arising from causes operating after uterine life, there is but slight deviation from normal condition in the state of the mouth and teeth, while it is in those whose malady is congenital, especially where arising from causes operating at a very early period of embryonic life, that the deviation of the mouth and its appendages from a normal condition is most pronounced.

It often happens to me to see children, about whom the only anxiety is that they do not speak. The parents seek for an explanation in the condition of the palate, little suspecting that the palatal deformity is only one of the manifestations of a congenital mental defect, in which ideas are so little formulated that language is not needed.

I could occupy a large portion of the time of this meeting in illustrating the value of an appeal to the condition of the mouth as an aid to diagnosis in such cases: a few must suffice.

A year or two since a very intelligent medical practitioner in the country was called in to treat a case of infantile convulsions. The condition of the child was desperate. He poured from an ewer a stream of cold water over the occiput of the child; the convulsions ceased, the patient

was rescued from impending death, but grew up to be an idiot. The friends of the child took up a position which involved a trial in a court of law, equivalent to an action for malpraxis against the medical man. By a judge's order, I, with other medical men, saw the child; and we were able to say not only that the child was an idiot then, but, by an examination of the mouth, to assert that the idiocy was embryonic as to date, that the convulsion was an epiphenomenon, and that the medical man was in no way responsible for the mental condition of the child whose life he had rescued. Thus, by an appeal to physical conformation, we were able to date the mental defect, and to save the reputation of a medical brother from undeserved opprobrium.

It will be within your remembrance that this town was some years since greatly moved by a sensational trial before a Master in Lunacy, in which an attempt was made to save from himself a youth with an honoured name. Liberty of the Subject was the popular cry, and after conflicting evidence, the popular will prevailed, and the free agent went rapidly to his doom. The counsel for the defence, in specious terms, suggested that the mistake about this young man's imbecility arose from a defect in his mouth, by which imperfect speech resulted. I showed at that time—too late, however, to influence the verdict—that

that was the most important admission that could be made,—that, given any amount of mental obliquity, no stronger confirmatory proof could have been adduced of his imbecility than the physical defects of mouth to which this lisping speech was due. The sequel proved the congenital nature of the case.

No less valuable, however, is a study of the condition of the mouth as a means of prognosis in any given case. In children who exhibit any want of mental power, or present anomalous moral or intellectual symptoms, no more anxious question is suggested than that relating to the future of the case. The disposition of property, and other family arrangements, depend a good deal on the answer which is given. We have learned by experience this important fact, that the child who has been born with defective intellect is more susceptible of improvement by physical and intellectual training than the child who has been born with full possession of his brain-power, and has afterwards been deprived thereof. In other words, that of two children who are the subjects of solicitude, other things being equal, there is greater probability of improvement for the patient with an ill-developed, than the one with a damaged, brain. Often it happens that a microcephalic idiot, about whom the inexperienced would entertain no sort of hope, will far outshine, under intellectual training,

the fine, well-developed boy the membranes of whose brain have been the subject of inflammatory lesion, and about whose capillaries lymph has been inextricably effused. An appeal to the condition of the mouth is an important aid in determining whether the lesion on which the mental weakness depends is of intra-uterine or of post-uterine origin. In the event of the mouth being abnormal, it indicates a congenital origin; while if the mouth be well formed, and the teeth in a healthy condition, it would lead to the opinion that the calamity had occurred subsequently to embryonic life.

Of course, our judgment would be formed after a physical examination of every organ—of the condition of the ears and eyes—of the shape of the cranium; but what I want to enforce is, that most important information is derived from an examination of the mouth.

I have had this day brought to me a young girl of manifestly defective power, and the parents were extremely anxious to know whether it was a congenital case. Their anxiety was based partly on an unwillingness for either branch of the family to allow that there was on their side any hereditary tendency to mental disease—a sort of rivalry as to the purity of the two antecedent sources; but mainly also to ascertain with what degree of fear they must watch the development of their other children, and how it might affect

the education of their sons, or the marriage prospects of their daughters. No study of the mental phenomena themselves would have enabled me to venture an opinion; but an examination into the totality of the physical conformation in general, and of the mouth in particular, enabled me to refer the calamity, with a considerable degree of certainty, to a sun-stroke in the tropics; to clear the other members of the family from the suspicion of insane proclivity, and to defend the purity of the rival stocks.

Let us now consider what are the conditions of the mouth associated with mental defect.

The lips are usually thick, the thickness being greatly more marked in the lower than in the upper one. In addition to the thickening, they are often striated, marked by transverse fissures: this character is more generally seen in a class of congenital idiots, which I have elsewhere described as Mongolian idiots, from their resemblance in physical character to the Mongolian race. Often the lips are deficient in muscular power, which interferes with their prehensile function, and which also induces a tendency for the saliva to run over the chin. The mucous membrane is extremely liable to chronic inflammation, and ulceration is induced by the slightest pressure against prominent or uneven teeth. The glands of the mucous membrane of the mouth generally, as well as the salivary glands, are usually hypertrophied;

and this is another factor in the production of stammering.

There is a marked postponement in the evolution of the first teeth. Looking over my notes of a very large number of cases, I find that the first dentition is almost invariably postponed. The ease with which dentition is effected varies; sometimes the teeth are cut so easily that no disturbance to the general health is observed; in others it is the period at which violent convulsive attacks are developed, imperilling greatly the feeble mental endowment of the child. Contrary to the law that tissues which are slowly formed are the more persistent, these primary teeth have a more temporary existence than usual. They are frequently dark, speedily become carious, and their stunted growth often the more stunted from the incessant grinding of the teeth, which is so frequent during the infantile life of such children. I have often been curious to ascertain the cause of this grinding. In most cases it appears to be a kind of automatic movement, not depending on the direct influence of the will; one of those rhythmic movements of which there are several amongst children of this class. In others it would appear to be purposely developed to produce a monotonous sound, which imparts pleasure to the feeble-minded. Not only, however, are the primary teeth ill-developed; they are often irregularly developed as to

sequence. Nothing but disorder is noticed in their succession.

Just as the evolution of the temporary teeth is accompanied by cataclysmic effects, like phenomena not unfrequently accompany the evolution of the permanent teeth. The epileptiform convulsions which accompany the first, not unfrequently, after a long interlude, reappear at the cutting of the second, to be followed by another interlude, and a recurrence at puberty. I have now under my observation a boy whose first teething was marked by paroxysmal phenomena of the most violent kind, which ceased when the physiological effort was over. He has now arrived at the period of second dentition, and the evolution of every tooth is accompanied by well-marked epileptic attacks, and by a corresponding decadence in his stunted mental development.

The evolution of the second teeth is also frequently postponed, and there is slight irregularity in the sequence of their development. A marked character of the teeth is their irregularity as to position. They are often crowded—so crowded as to present their sides instead of their anterior surfaces. They are often arranged on different planes. The canine teeth are frequently unduly prominent, and a marked sulcus is sometimes seen between the incisors and canines, with prominence of the incisors. The teeth themselves present very frequently a honeycombed appear-

ance, from an absence of continuity in the enamel, and they undergo speedy decay. Nothing is more marked than the temporary nature of the so-called permanent teeth.

It has been a matter of considerable interest to me to ascertain how frequently the syphilitic teeth, so well described by my friend and colleague Mr. Hutchinson, were to be met with among the feeble-minded; but the result of my inquiry has been to discover very few among them who were in this way indicated to be the subjects of congenital syphilis. Very few have had syphilitic teeth; but where I did discover them, I always had confirmatory evidence of the syphilitic history of the case, and the condition of the teeth was always associated with the chronic inflammation of the cornea to which Mr. Hutchinson has called attention. I have, therefore, been led to the conclusion that syphilis is not by any means an important factor in the production of congenital mental disease. The honeycombed teeth are, I am persuaded, perfectly distinct from the syphilitic, and are manifestations of that grave perversion of nutrition which implicates in these cases every tissue in the body.

The tongue presents peculiarities worthy of notice. It is frequently unusually large. Its inordinate size generally arises from increase in length, and also from an absence of muscular tonicity. The surface is often curiously corru-

gated, presenting numerous fissures. The surface is rendered still more rough from hypertrophy of the papillæ. Not only is the tongue inconveniently large, it is but feebly under the influence of the will. There is a want of co-ordination in its muscles ; so that not only is the more intelligential act of speaking performed awkwardly when even there are ideas to be communicated, but the simple voluntary act of conveying the food to the posterior part of the mouth, where the reflex act of deglutition is excited, is effected with difficulty, and thus an almost instinctive act is rendered to some extent abortive.

Of most significant value, however, is the condition of the palate. I have made a very large number of careful measurements of the mouths of the congenitally feeble-minded and of intelligent persons of the same age with the result of indicating, with some few exceptions, a markedly-diminished width between the posterior bicuspids of the two sides. The exceptions were some few cases of Macrocephalic idiots, who had inordinately-large crania, depending in some cases on hypertrophy of the brain, or more frequently on chronic hydrocephalus. In these exceptional cases the palates were as widely in excess as usually they are less than the normal width. One result, or rather one accompaniment, of this narrowing is the inordinate vaulting of the palate. The

palate assumes a roof-like form. The vaulting is not simply apparent from the approximation of the teeth of the two sides, it is absolute—the line of junction between the palatal bones occupying a higher plane. Often there is an antero-posterior sulcus corresponding to the line of approximation of the two bones.

There is very frequently a deficiency in the posterior part of the hard palate, from a want of development of the palatal process of the maxillary bone, as well as absence of the palatal process of the palate bone. As a result of this defect, the false palate hangs down abnormally, and interferes with clear phonation. At an early period of my investigations I was prepared to find a large number of cases of cleft palate. This does not appear, however, to be a frequent defect —not more, according to my statistics, than five in one thousand cases. Bisection of the uvula occurred four times in one thousand, and absence of the uvula twice. The cause of this frequent excessive vaulting of the palate is not quite clear; it may possibly arise, as has been suggested, from arrest of development of the sphenoid bone, or defective growth of the vomer. It has been attributed by one writer to a cause which I think cannot be allowed, viz., sucking the thumb. This gentleman attributes idiocy entirely, or almost entirely, to fruitless sucking. The chain of events, according to his theory, is this:—The fruitless

sucking gives rise to secretion of gastric juice in the stomach when it has no physiological use,—that this acts as an irritant on the intestinal mucous membrane, giving rise to diarrhœa and disturbed nutrition, eventuating in convulsions and idiocy ; and that the roofed palate I have described is the physical result of the pressure of the child's thumb against the palate. Banish fruitless sucking, and idiocy would be unknown. I believe this to be a thoroughly mistaken notion. Idiots are not much more prone to fruitless sucking than other children, and I have examined the palates of several fruitless suckers among the sane without finding the palatal defects I have described. I think it will require no argument to prove that the defects I have described are developmental defects, and that they betoken a cause long anterior to the time when sucking the thumb is practised, unless that habit be an intra-uterine one. The theory overlooks the whole bearing of hereditary influence, and of nervous shocks and physical illness to the pregnant woman, as potent causes of imbecility in the offspring, and negatives the idea of the congenital nature of the ailment.

There is one practical point with reference to the palatal defect which has some interest to me. One of the greatest difficulties we have, but one which, when overcome, brings the greatest *kudos*, is the teaching an idiot or imbecile to

speak. We have to furnish him with a vocabulary, to practise him in tongue gymnastics, to build up for him a language, and to lessen the mutiny of the muscles of his tongue. When all this is in part accomplished, the arched roof of the palate is a great trouble. Imperfect speech still remains. Can nothing be done mechanically in this direction? Can the members of this Society tell us of any success they have had by diminishing the palatal cavity among the sane, that may augur hope for us with the insane? Often cases are met with where the palatal difficulty is just the hindrance to an improved imbecile mixing with the world, and taking his place with his fellows.

Among idiots and imbeciles there is often discovered a want of symmetry in the cranium. The plan which I adopt of taking the shape with a strip of lead shows this defect admirably, and enables me to sketch the precise deformity on paper. This want of symmetry also affects the bones of the jaw, leading to a great difference between the two halves of the maxillary bones. A very marked example of this kind was seen with me a short time since by my friend Mr. Ramsay, who advised the removal of some teeth to make room for the movements of the tongue. It was an excellent example also of the obtuseness to pain which is common among the feeble-minded. Often they are anxious to have their

teeth extracted, as if it were a personal favour; they are flattered by the attention,—rarely do they care for the pain which is inflicted,—chloroform is for them a superfluity.

A want of symmetry is occasionally noticed in the palate when there is no very marked absence of symmetry elsewhere.

I might also mention anomalies of the tonsils and of the fauces, but these would have but little interest to you.

The gums are extremely prone to recede from the teeth, and to become tumid, as in the scorbutic condition.

The masticatory process is always performed with difficulty. The carious condition of the teeth is one cause of this, but it is principally due to the imperfection with which any voluntary act is performed. The sense of taste is obtuse, no medicine, however nauseous, is refused, and without care many will eat with indifference the most offensive garbage.

To sum up, we have in the condition of the mouths of idiots important data for distinguishing between idiocy of a congenital and that of a non-congenital origin, and to base thereon a prognosis as to relative improvement by treatment. They are, the thickness of the lower lip, the delay of dentition, premature caries of the teeth, the irregularity of dentition, the chronic inflammation of the gums and buccal

mucous membrane; the height, angularity, and want of symmetry of the palatal vault; the long, corrugated, and coarsely-papulated tongue, and the hypersecretion of saliva. Common to the congenital and non-congenital cases we meet with defect of mastication, a want of co-ordination of the muscles of the tongue, and the slight development of the faculty of speech.

I am anxious to hear from the members of this Society their own experience with regard to any feeble-minded patients that may have come under their observation, and how far the picture I have drawn from nature contrasts with what they meet with in members of a sane community. It is quite possible that some of the characters I have noted may be met with sometimes among those who are doing their work in the world, and are among the bread-winners of society. My own experience leads me to consider that they are exceptional cases. May not palatal deformities be indicative of a slightly degenerative process? When investigating cretinism in the valleys of Piedmont, one is struck with the very gradual deterioration of the race. Some of the typical features of cretinism are met with among the grandparents who are doing part of the world's work, and we have been able to trace the increased degenerative stages through the children to the effete grandchildren.

I have often had a lingering wish to measure

and note the condition of the mouths of some of the progenitors of my patients, and trace—as I believe in some instances one could trace—the gradual deterioration of the species till it culminated in congenital imbecility.

That is just the link that I have not been able to forge. I know no men more likely than those I have the honour to address to-night to be able to fill up, from their experience, the shortcomings of my own.

Discussion.

Mr. Oakley Coles, for some two years past, had been experimenting upon the anatomy and physiology of the palate, and seemed to have been working side by side with Dr. Down. His results, to a great extent, confirmed those of that gentleman. Being desirous of obtaining accurate information respecting the conformation of the palate of living subjects, he had adopted the very simple plan of using a plain strip of rubber, perforated at fixed intervals, through which brass points were applied, and made easily to fit the skull. By the movement of the points and their accurate adjustment the outline of the skull was placed on paper, and by the continuation of the points an accurate and clear sketch of the skull might be obtained. Where the hair was thin and scarce, the drawing would be much more accurate, the instrument being applied closer to the skull. To obtain the shape of the palate, a strip of lead had merely to be applied. Mr. Oakley Coles produced some sketches of the transverse and longitudinal sections of the skull and palate. He would like to take that opportunity to ask those present to assist in such investigations, for it was impossible to arrive at any definite conclusion, unless they had illustrations and histories of a large number of cases. The exhibition of a few cases was but encouragement to go deeper into the subject, and if all present would do this they would be doing most valuable service. He might add that, with regard to abnormal developments, he had found that in cases of congenital cleft palate there was frequently flattening on one side of the skull (usually the left), and that when the cleft extended through the maxillæ the vomer was continuous with the borders of the palatine process of the maxillary bone. The flattening of the side of the head also occurred in nearly all cases in which they found any departure from the contours of the normal dental arch and palate.

The President expressed a strong hope that the discussion would be continued, adding that it would be very interesting to know how far these contracted palates were found among persons not suspected of suffering from any mental defect.

Mr. Turner would be glad to know if Dr. Down had observed any peculiarity in the size of the teeth of imbeciles. In an asylum which he had recently visited he had observed that some of the mouths of the patients looked more contracted than they really were, owing to the great size of the teeth filling up the oral cavity.

Mr. Lawrence Vanderpant thought that, notwithstanding the able manner the subject had been treated by Dr. Down, the ideas of most of the members were limited with reference to it; and he suggested that, considering its interesting character, it would be well to defer the discussion of it until the next meeting, for, doubtless, when the printed Transactions were circulated, members not now present would furnish much appropriate matter on the subject.

The President, while wishing the fullest discussion on this subject, which was a question bearing an entirely new aspect to them, could not countenance the motion. Though it was a question which would set them thinking, he was afraid that they would not, in a month hence, be able to bring together sufficient data to fully discuss the subject. If in so full a meeting they could not get a thorough discussion, it was not likely they would fare better at the next meeting. All he could hope was that when they had brought their notes together, Dr. Down might be induced to favour them again with his presence.

Mr. G. R. Keeling, although he had been a member of the Odontological Society for several years, was practically a stranger among them, but had been induced to attend that meeting by the announcement of the paper to be read by Dr. Langdon Down. He had understood Dr. Down to ask for information respecting the gradual degeneration which might

have taken place in the successive generations of the parents of imbecile children. He was in a position to afford such information. He knew the grandfather and the mother of an imbecile child (the latter, he had reason to know, had been under the care of Dr. Down), and if the discussion were postponed he should be happy to produce the models of the mouths of the grandfather and the mother, and perhaps of the imbecile child's mouth also; and the models would show that a very marked and gradual deterioration of the palates and teeth had taken place in the mouths of the individuals referred to, from the grandfather to the imbecile child.

Mr. C. Tomes wished to ask for further information on one point, whether Mr. Vanderpant's proposition to adjourn the discussion was pressed to a division or not, and it was briefly this. The great characteristic described by Dr. Langdon Down, as found in the mouths of congenital idiots, was that malformation familiar to dentists, under the name of V-shaped maxilla. Now, this deformity did not attain to its full development until the period of the second dentition; until, in fact, the permanent teeth were in their places; and although many naturalists, notably Mr. Darwin, had pointed out that there were many characters in animals of strictly hereditary origin which were not developed till an advanced period in the creature's life-history, he would be glad to hear how far these peculiarities noted by Dr. Langdon Down could be observed at the time of birth.

Mr. Vanderpant's motion was not seconded.

The President felt that he could not have asked Dr. Down to come again in so short a space as a month hence. Gentlemen had come unprepared for efficient discussion, and he must himself confess to having so carefully preserved three models, which he thought might be useful, that he could not lay his hands upon them. But, though, perhaps they had failed properly to discuss the paper, he thought they could all do what Dr. Down asked, and record observations whenever opportunity occurred; and he put it to the meeting

whether that was not the best way of appreciating his excellent paper.

Mr. SERCOMBE would suggest the desirableness of obtaining a large series of models of the mouths of idiots. Probably Dr. Down had some dental friend who would be glad to take them if he could introduce him to the asylum. In this way most accurate portraits would be obtained. Dr. Down's remarks about the high-vaulted palate and lunacy being commonly associated, had much struck him, and brought to his mind the conditions of one of the oldest families in the realm, who were patients of his, in whom every branch of the family had remarkably high V-shaped palates, and at least two members of the family had been in confinement. In this family the chief contraction was between the bicuspids. With respect to any advantage to articulation being derived from filling up the roof with a plate he (Mr. Sercombe) might state that he had done so with advantage in two cases.

The PRESIDENT remarked that the time was now advanced, and it would be well not at present to further prolong the discussion. The subject was one of the greatest interest and profit, and he had no doubt that, in consequence of Dr. Down's suggestions, we should get at some valuable results, and that at a not very distant period his kind services might be again secured, when all could bring forward their data, and submit them to his consideration. He had only now to tender the hearty thanks of the Society to Dr. Down for his admirable and most interesting paper.

Dr. DOWN, while admitting that the correlation of form between the palate and the skull was of the greatest possible practical interest, could not say so much for his method of measuring the skull, and feared it would be discountenanced by phrenologists. The gentleman had misunderstood him when he imagined that he advocated that the mental power was the outcome of the physical form. All he wished to point out was their wonderful correlation, how they went hand in hand, and were the outcome of one another. In reply to Mr. Tomes's

most pertinent question, he might say that the V-shaped mouth was met with at the first period of dentition in congenital diseases. Mr. Sercombe's remarks were but a confirmation of his belief in the gradual deterioration of the race, and if models of the mouths of every patient were taken, we should be convinced of the fact shadowed forth by the aristocratic mouth, and the dying-out of the race. In conclusion, he had but to thank the Society for their patient and kindly hearing.

Mr. Oakley Coles then read the following paper :—

On the Celluloid Base. By Oakley Coles, Esq.

Mr. President and Gentlemen,—

The Albany Dental Plate Company have taken out patents and sent over specimens of a new base for artificial teeth. This composition is said to consist of solid collodion, prepared in a peculiar manner. It is really gun-cotton and camphor, and from the specification we learn that

"In the manufacture of collodion for these dental plates the inventors prefer to use at least fifty parts by weight of gum camphor to one hundred parts of soluble cotton (a greater proportion of camphor may be used), whereby the product is rendered more plastic than when a less quantity is employed. The collodion thus produced is made into plates of suitable thickness, which are preferably formed into shapes approximating to those of finished dental plates by pressure in heated moulds. The plates thus formed are now thoroughly dried by placing them in a drying-room heated to a temperature which should not exceed 180° Fahrenheit, 150° to 180° being the temperature found best adapted for expelling the camphor solvent. A temperature much higher than 200° will expand the material, and render it porous and brittle. The plates when properly dried, although freed from liability of shrinkage, still retain the quality which enables them to become plastic under a proper degree of heat, and may be readily moulded into any desired shape without subsequently shrinking to any injurious extent."

There are two varieties,—the coloured, which is of a gum-like pink; and the uncoloured, which is semi-transparent, and of an amber-yellow.

We will first take the properties of the two, and then their application to dental purposes.

Both are stronger and lighter than any dental rubber. The uncoloured celluloid is, however, stronger and lighter than the pink, but the amber-coloured base is more liable to warp than the pink.

In opposition to the statement contained in the circular sent out, I must state that in my experience both kinds are affected by the acids of the mouth: the uncoloured, instead of remaining semi-transparent, assumes an opaque appearance, becomes much harder, and is discoloured by blood; while the pink, after a few weeks' wear, has a white granulated look over the surface. These changes, however, do not affect the durability of the piece.

It has a strong smell, and a slight taste of camphor, which remains for five or six days; it is not, however, as a rule, objected to by patients, and to many is not even unpleasant.

To remove the smell of the camphor, if it should be found objectionable, the piece may be placed for four or five hours in a solution consisting of sulphuric acid one part, and water two parts, a larger proportion of acid affecting the piece injuriously. This suggestion I give on the authority of the inventors.

With chlorætherine it is converted into a soft gelatinous mass, but is not dissolved; and as

the chlorætherine evaporates, it again becomes hard. With sulphuric ether the surfaces of two pieces may be softened, and, being kept in contact for three or four hours, will become as one. Pieces cannot be softened so as to unite together by dry heat.

The older the plates are when received from the depôts, the stronger they appear, and the less liable to shrink ; this, I think, is owing to the evaporation of a portion of the camphor which they contain. All parts brought into contact with metal of any kind become white and opaque more quickly than the rest of the piece.

Pieces may be softened and allowed to harden any reasonable number of times without any apparent deterioration of texture. The temperature of the mouth does not affect it injuriously, but the heat of boiling water will soften it. Boiled for ten hours in water it becomes deprived of a large portion of its camphor, and remains a white friable mass.

As to the mode of using it, I would say that I do not think we have arrived at anything like perfection, nor even do we yet know the simplest way of applying it.

The plan I at present adopt is, after sinking the pieces made up on wax in the flask, as if for vulcanite, to choose the base of an approximate size, cutting away any portions that

may appear in excess, and then softening the celluloid sufficiently in boiling fluid to enable it to be pressed into shape in the flask with the fingers; the two parts of the flask can then be brought more closely together at the beginning, and there is less risk of injuring the plaster castings. When the flask is nearly closed, I open it, and cut out gutters for the excess that may be present. This plan insures plenty of the base being pressed well round the teeth, and into any overlaps that the piece may have.

Gutters having been freely cut, the flask may be completely closed, after the heat has been increased sufficiently, and then the whole taken out of the tank and placed in cold water, where it should remain for twenty minutes.

The best flask, clamp, and tank for the purpose are those recommended and sold at the depôts, as being made by White, of Philadelphia; the principal feature and advantage being that the flask can be gradually closed while it is in the boiling fluid, which cannot be done in the ordinary way.

As to the fluid in which the piece should be softened, I think milk the best; it is not so injurious to the celluloid as I consider water to be, and it is not so unpleasant to use as oil. Dry heat I believe to be unsatisfactory. The plaster, if mixed tolerably stiff, is quite strong enough without the addition of any substance,

such as gum-arabic; in fact, in using water it becomes so hard as to be difficult of removal from the flask. To prevent the base adhering, the castings may be painted over with oil, or dusted over with French chalk. The piece can be finished up in the ordinary way with scraper, file, and glass-paper, or, better than glass-paper, at the lathe with a wet hard brush, plenty of water, and coarse pumice, afterwards whiting and oil, and finally a dry felt cone with dry whiting, or, according to White's circular, the dry cone alone. It may be repaired in the same way as vulcanite, by dovetailing; but I do not think the pieces, as a rule, become thoroughly welded; this, I believe, can only be perfectly done by means of a solvent. By immersion in boiling fluid any part of it can be altered in form, in the same manner as vulcanite, and should afterwards be put into cold water to thoroughly re-harden.

At present I have no great faith in its use for repairing vulcanite—there is simply mechanical union; and, as the two substances are of such very different density, they do not hold very firmly even when thoroughly dovetailed.

After a series of experiments, carefully conducted, with the celluloid base, I have obtained the following results:—

Taking first the essential oils:—Two grains of the base reduced by filing to a fine state of

division, were placed in a test-tube containing oil of Cassia, and the result was a transparent gelatinous mass, insoluble with heat. With oil of Cloves we found the same action; with oil of Rosemary a slightly-gelatinous condition was seen to be present, but it was not soluble; and with oil of Origanum it was not acted upon at all.

In Benzole, rectified spirits of wine, pure Ether, and Potassium Naphtha, it was quite insoluble. It is but very slightly soluble in Chloroform, and it is not acted upon at all by Thymol in any of its forms.

By the action of Creosote, when heated, it shows a mass in a gelatinous form suspended in the liquid; and in Carbolic acid we have the same conditions, only more strongly marked.

If placed in a vessel containing any of the fatty oils, and heated up to their boiling-point, it is completely decomposed, leaving only a residue of carbon; the same thing happens if heated alone in a test-tube, the camphor being driven off, and leaving carbon behind. In fact, the application of great heat (especially dry heat) causes the camphor to be driven off, and tends to the rapid disintegration of the compound.

I have been anxious to bring forward the results of these experiments, because I think that the celluloid base may be prepared in such a way as to be most useful for a temporary stopping;

it was therefore important that we should have some knowledge of the action of those preparations with which it might be brought into contact in a tooth, as, for instance, carbolic acid, thymol, and others.

From the comparative facility with which the celluloid can be prepared, and the ease with which it can be produced in any colour, I have fair hope we may obtain some temporary stoppings of great value for many cases. This, however, is a matter for future consideration.

In conclusion, I consider the base a useful introduction, but not one of great value at present; still, it is so good, that I believe it is capable and worthy of improvement.

For artificial dentures it is comfortable and light to wear, the pink is natural in appearance, and it adapts itself well to the mouth; how it will last, time alone can show.

Discussion.

The President was afraid that the camphor (a highly volatile concrete essential oil) would soon be eliminated from the compound, the constituents of which he thought were bound together by a mechanical rather than a chemical union. He proposed the adjournment of the discussion until the next meeting.

Mr. Turner hoped that before the next meeting some gentleman would have experimented upon it, and report the result to the Society. For himself, he had tried it and found it utterly deficient in strength.

Mr. Moore (Plymouth) showed some prepared by steam, which had answered better than other processes. It was prepared at 220 degrees Fahrenheit, and it had come as it stood from the matrix. It was unpolished, and yet it was well flushed in every part. If some gentleman would experimentalize, they would find that by the use of steam the whole of the parts might be welded together, and the thing produced in a more substantial form, as would be the case with india-rubber, if we could get rid of it attendant sulphur.

The President, in the name of the Society, thanked Mr. Coles for his paper.

And the meeting adjourned until the 4th December.

GENERAL MONTHLY MEETING,

Monday, December 4, 1871.

JOHN R. MUMMERY, Esq., President, in the Chair.

The Minutes of the previous Meeting were read and confirmed.

The following gentlemen signed the Obligation Book :—

Mr. Charles Gaine, M.R.C.S., Bath.
Mr. William Alfred Hunt, M.R.C.S., Yeovil.
Mr. Morris Dickenson, M.R.C.S., Hastings.

The President stated that Mr. Forsyth had presented to the Society a model of the mouth of a child seven years old, exhibiting five permanent lower incisors. Mr. Saunders had also presented to the Society a very curious group which he had met with in Paris, representing the process of extraction. The victim—for no other term could be applied to a patient in such a position—was, judging by the surroundings, the bread lying on the floor, &c., without doubt a journeyman baker; the operator was evidently a barbarian.

Mr. Ramsay said Dr. Langdon Down had, in his paper read at the last meeting, mentioned a case which he (Dr. Langdon Down) had brought to him, as illustrating and supporting the theory he was then bringing before the Society as to the formation of teeth in patients who had a tendency to idiocy. Fortunately, on returning home after the last meeting, he found he had a model of the case, and had brought it with him that

evening. They would see on the left-hand side of the mouth a cuspid, which, from its position, must have interfered very much with the patient's tongue. This tooth was at once extracted. Two months after this he recommended the extraction of the first molar on the opposite side, which also obtruded very much towards the palate. Beneficial effects resulting, he subsequently extracted the one on the other side, and the mouth had assumed a very nice and perfect shape. He did not think the palate was much higher than the majority of those that came under their notice.

Mr. Harrison asked Mr. Ramsay how long a time had elapsed after the extraction of these two molars when he last had an opportunity of seeing this patient. He was induced to ask this question because he himself had had a similar case many years ago (except that in his case the contraction of the jaw from side to side was greater than in Mr. Ramsay's), which he had treated in a similar manner, with, at first, apparently a satisfactory result; but in which the ultimate result proved, nevertheless, very unsatisfactory. The other teeth, in his case, being large, and, there being a probability therefore that there would not be room in the jaw for the wisdom teeth when they came. he extracted the two first molars, in the hope that the second molars (which were in a line with the bicuspids) would have been pressed forward in that line, and the deformity in the jaw thus connected in the easiest possible way. Down to a certain time this process appeared to be going on satisfactorily, when he lost sight of his patient for two years; and at the end of that time, on seeing him again, he had the mortification to find that the second molars had taken precisely the same positions in the alveolar arch that the first had occupied, and that the palate was as contracted from side to side as before. It was from his experience and disappointment in this case that he asked Mr. Ramsay the question he had put to him.

Mr. Ramsay saw the patient about two months after these extractions, but had not seen him since. He had asked Dr. Langdon Down whether he had seen the patient lately, and as to whether there had been any improvement in the articula-

tion. Dr. Down had not, but he would try, if possible, to see him himself. He would leave the model with the Society, and would use his utmost endeavours to obtain a model of the present state of the mouth.

The PRESIDENT thought that they could not arrive at a correct decision in any such case, until the eruption of the third molar. The after-history of such cases was a matter of deep importance, and there was great weight in Mr. Harrison's remarks, urging a delay in coming to a decision.

Mr. HARRISON said that he had met with many curious "physiological facts" (he supposed he must call them) in connection with the regulation of teeth; but as, with the papers they had before them, he did not wish to occupy the time of the Society long, he would content himself with narrating one, which had recently come under his notice, and which he thought could not be otherwise than interesting to the members. Many years ago he regulated the teeth of a lady, then in her girlhood, under the following circumstances. The central incisors of her upper jaw, which was somewhat elliptical, lapped one over the other, her lateral incisors overlapping them. She had also a crowded and irregular condition of the incisors of the lower jaw. By the removal of two upper bicuspids and one of the lower incisors, and the use of mechanical appliances, he got the teeth in both jaws so well placed that they were admired for their regularity and beauty after this young lady grew up; and he obtained (he might be allowed to say) from the lady herself, and her friends, a proportionate amount of praise and reputation for what he had done. These teeth kept their new position for about 17 or 18 years (the lady being now 33), as he (Mr. H.) knew, for he had had frequent opportunities of seeing her during that time. About three months ago, however, this lady came to him, saying that she had noticed, during the last twelve months, that the front teeth were beginning to overlap again, and that they now overlapped so much, that she wished to know whether anything could be done to carry them back into what she termed "their proper positions." A glance at the mouth showed him that her state-

ment was correct. He examined it carefully to see whether there was anything in "the bite" to account for this change, but found it perfectly clear as regarded the incisors, as he remembered to have left it when he regulated the teeth. He also looked to the wisdom teeth, to see whether there was a late cutting of one or both of them, to account for it; but found that they were fully erupted, and that there was no crowding of the teeth on either side of the jaw, inasmuch as both the first molars were a good deal cut away for interstitial stoppings. Here, then, was a case in which teeth that had been regulated, and kept there new positions for 17 or 18 years, were going back to their old positions without any assignable cause! This was one only of many somewhat similar cases he had met with, showing the tendency of regulated teeth to go back to their old positions, unless kept in their new positions by antagonists, at almost any distance of time,—although this was by far the longest date at which he had known the occurrence to take place; and he confessed that he was puzzled to account for it. He might add that, at this lady's present age—she being married and the mother of a family—he advised her to let matters take their course.

The President said that he had occasionally noticed, in cases where the mental power was deficient, the front teeth were not on the same plane as the molars. In the case in question, he thought the incisors could not have met their antagonists.

Mr. Ramsay: No, they did not.

Mr. Coleman said, at the May meeting, he had exhibited a very ingenious gag for keeping the mouth open during the process of the inhalation of nitrous oxide, or other anæsthetics; and, after some months' experience of the instrument, was able now to say that it more than fulfilled what he had then ventured to promise would be its advantages. That gag was contrived by Mr. Hutchinson, a student of the Dental Hospital, and he now had the pleasure of introducing to the meeting that gentleman's automatic mallet. He feared he was not the right person to point out the merits of such an instrument, as he

rarely used a mallet. Mr. Hutchinson was present, and could best describe his own invention.

The PRESIDENT requested Mr. Hutchinson to exhibit the *modus operandi* of his mallet.

Mr. HUTCHINSON was glad to have the opportunity of saying a few words about the mallet, and he thanked Mr. Coleman for his very kind introduction of it. The reasons which led him to devise such an instrument were simply these. He felt the great need of a mallet which could be easily worked by one hand of the operator, without the help of an assistant, and which would give a blow most like that given by the hand-mallet. He found that the concussion given by a strong piece of watch-spring more nearly approached to that given by the human hand than that by any other instrument. Further, he wished to construct a mallet which could be attached to any kind of plugger; because his experience had taught him that each operator had his particular form of instrument, to which he was thoroughly accustomed; and he himself had got to use some instruments which, from the force of habit, he could hardly do without. The mallet was so made, that it could be attached to any ordinary steel-handled instrument, and the instrument could be changed when required as easily as a "bit." The blow was given by a heavy piece of lead, and was direct and steady. His experiments had led him to the conclusion that patients preferred the "dead" blow of lead to that of any other material; and this form of mallet could be used with any degree of weight at the end of the spring. At first there might appear some little difficulty in working it; that was soon mastered; and therefore did not prevent its recommendation to the profession, because it was only by skill and constant practice that the perfect use of any instrument could be gained. He did not wish to draw comparisons, nor to say that it was better than other instruments of a similar character; he was sensible that it might be open to improvement; but if it proved of use to the profession, his object would have been gained.

He would say that Messrs. Ash had undertaken its con-

struction, and to them he was indebted for the well-finished model shown.

Mr. Sewill exhibited a model of a case of irregularity of the upper central incisors of a nature rarely met with.

He then related a case of chronic enlargement of the glandulæ concatenatæ, which closely resembled the scrofulous variety of that affection, but which was believed to be due alone to the irritation of a decayed tooth. The patient was a lady, about 25 years old. The glands slowly increased during upwards of a year, in spite of the persistent use, under Sir W. Fergusson, of the remedies usually employed in scrofula. She then applied to Mr. Canton, the surgeon, who after going into the case, gave it as his opinion that the enlargement was owing to the presence of a broken-down lower molar on the affected side. For the purpose of having this tooth removed she applied to him (Mr. S.). He found a chain of indurated glands, extending down the right side of the neck from the angle of the jaw to the clavicle, several of them being as large as an average-sized walnut. The second lower molar, on the same side, was broken down to the gum. He removed this tooth, and found that the roots had been the seat of chronic inflammation and abscess. After this operation an improvement was noticed within a week by Mr. Canton and himself; and since that time—July last—the glands had slowly decreased, although the medical treatment previously carried out was abandoned. Mr. Sewill pointed out that, pathologically, the diseased roots would satisfactorily account for the glandular enlargement. He adduced reasons why this case was probably not scrofulous in its origin, and he dwelt upon the importance of removing such roots in similar cases, whether the patient were or were not of a scrofulous diathesis.

Mr. Coleman wished to show, on behalf of Messrs. Barth & Co., a very simple portable apparatus for nitrous oxide. The contents consisted of a small copper bottle (containing, he believed, thirty gallons of liquid gas), bag, tubes, and mouthpieces, &c.; and thus it contained, in a small compass, all the requisites necessary for visiting patients at their own homes.

He might state that the Messrs. Barth had expressed themselves willing to adopt the very severe test the Messrs. Coxeter carried out in pursuance of a suggestion of his, viz., immersing each bottle, after being filled, in boiling water. There could, he imagined, with ordinary care, be no danger in employing the bottles of liquid gas after subjection to such an ordeal.

The PRESIDENT asked Mr. Coleman if he had any idea of the dimensions of the bottle.

Mr. COLEMAN, did not know the exact dimensions, but certainly, for the quantity of gas, it was very small.

The PRESIDENT remarked, that if there were thirty gallons, it displayed a very high degree of compression.

Mr. COLEMAN admitted that there must be a great strain upon the vessel. For his own part he always thought that such vessels would be safer if the diameter were reduced: they could be made twice or three times as long with a much smaller strain upon them.

The PRESIDENT quite agreed with Mr. Coleman on this point.

Mr. CLOVER had recently adopted, in certain exceptional cases, a plan of administering nitrous oxide, by which, after the patient was somewhat affected by the nitrous oxide, he made the gas pass over a surface of ether, the vapour of which was then inhaled along with the gas. The anæsthetic was by this means maintained for a much longer period of time, after ceasing the inhalation, than was possible from the use of nitrous oxide alone. He did not make these remarks to influence ordinary practice, because the patients did not recover so quickly or so satisfactorily from its effects as they did from inhaling pure nitrous oxide. He might add that his process removed the objection patients had to the pungent and dis-

agreeable smell of ether. He wished to show his apparatus to the Society. It was, however, not quite finished to his satisfaction at present.

The following Paper was then read by one of the Secretaries :—

Remarks on "Inostosis," considered as a Variety of "Exostosis." By George Henry, L.D.S.

Mr. President and Gentlemen,—

Before alluding to my subject, I wish to quote the following casual communication from the Transactions of the Odontological Society for May last.

"Mr. Gibbons exhibited a superior lateral which he had extracted for a young lady seventeen years of age, the fang of which was absorbed into the pulp-cavity, apparently from the pressure of a retarded canine. When he first saw the case the point of the canine was visible above the lateral, and, considering that the alveolar process was injured by absorption, he advised the removal of the tooth."

Apart from the immediate interest of this case, it presented to my mind a physiological bearing upon a microscopic condition of tooth-structure, which I remember seeing described in Dr. J. Bruck's "Manual of Dental Surgery" * some eight years since, entitled "Inostosis in the Human Tooth," the article being found under the heading "Structure of Diseased Teeth."

---

* "Lehrbuch der Zahnheilkunde," by Dr. J. Bruck. Leipzig.

The fact of a permanent tooth being partly absorbed at the early age of seventeen, and this by a healthy process, similar to the natural absorption of the milk-teeth, and not caused by chronic inflammation, the most common cause of absorption in adult teeth, brought to my recollection Dr. Bruck's case of "Inostosis"; and his definition of it,—"a penetration of the cementum into the dentine or body of the tooth."

The term "Inostosis," which I have not met with in English dental works, does not imply the "opposite," but is expressive of a variety of exostosis, for it is similarly an external enlargement brought about by the recuperative power of the peridental membrane, differing from ordinary exostosis in this important particular, that it is preceded by absorption; therefore it may be regarded as "a growth of cementum in an absorbed depression on any part of the dentine."

Mr. Gibbons's interesting case reminded me that many permanent teeth doubtless suffer, in some measure, from absorption through a crowded condition of the teeth in the *maxillæ;* and if teeth so affected are not extracted, but retained, under a more favourable condition, due to one of the following causes,—either an expansion of the jaw, the completed eruption of the crowding tooth, or its extraction, the deposition alluded to is that which we should expect to take place as a process of repair; and, indeed, it is difficult to

account for the appearance presented by a case of inostosis in any other way.

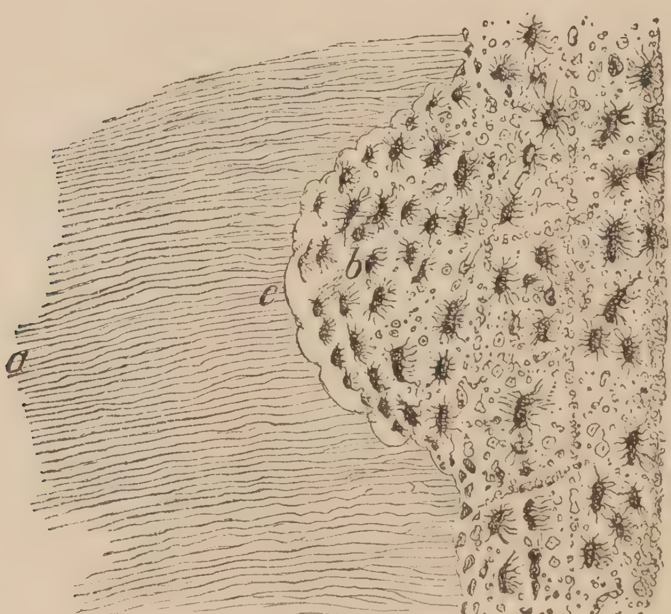
Mr. Tomes writes, in reference to cases where a portion of a permanent tooth is absorbed to make way for the eruption of a neighbouring tooth :—

"The extent to which the absorption of tissue is carried is usually limited to the production of a slight depression in the neck or root of the tooth; but in a few cases the process is continued until the pulp-cavity is laid open, and the pulp exposed.

"The canines of the upper jaw being more frequently mal-placed and retarded in their eruption than any other teeth, we should expect to find instances of absorption in the lateral incisors and first bicuspid teeth. But in these we seldom see more than a simple depression, towards which the advancing crown of the coming tooth has been directed. It is upon the second molars that the greatest extent of injury is inflicted. When the crown of a wisdom tooth is directed forwards, it leads to absorption in the neck of the obstructing tooth; and the process, though generally arrested before the second molar is permanently injured, will, in some cases, lay open its pulp-cavity." *

* "A System of Dental Surgery," by John Tomes, F.R.S., p. 454.

We find, accordingly, that lateral incisors, anterior bicuspids, and second molars, are the most likely teeth to be affected by absorption from crowding; therefore we shall be justified in presuming the case of a second molar, in the neck of which absorption has set up through the misdirection of the crown of a wisdom tooth; further, that a more forward tooth, say the anterior molar, is extracted, so making room for the wisdom to pass before too extensively injuring the second molar. In due time the action of the absorbent organ is suspended and substituted by a process of repair; the absorbed depression is made good by a deposit of cementum; and in this manner "Inostosis" may be said to arise.



On examining the accompanying illustration, taken from Dr. Bruck's "Manual," we notice at

once the festooned outline left by absorption (*c*), and that the dentinal tubuli at the deepest part of the hollow curtailed by absorption, exhibit few, if any, bifurcations; which fact points to a change of condition after original development. There is a free distribution of lacunæ, with their canaliculi, in the different layers of the cementum (*b*), more particularly in that contiguous to the absorbed depressions, and the laminæ are interspersed with granules, and occasionally intersected by transverse markings.

Dr. Bruck speaks of the appearance as most exceptional, and mentions one other example, which he had discovered in the tooth of a horse.

Two excellent examples in primary teeth are illustrated at pages 85 and 86 of Mr. Tomes's "Manual," but the author gives them no particular designation.

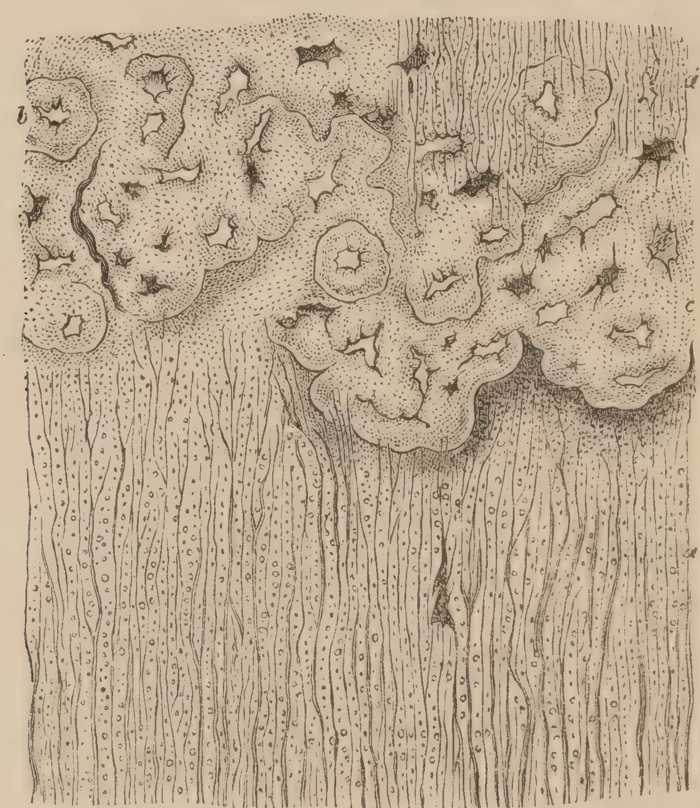
I have also observed an example of inostosis in fig. 6, pl. cxii., one of the plates illustrating Alexander Nasmyth's "Memoirs on the Teeth."* He merely alludes to it, however, as a considerable growth of *crusta petrosa*. In this section the root of an upper molar shows, at the thickest part of the cementum, the festooned outline before mentioned.

---

* "Three Memoirs on the Teeth and Epithelium," by Alexander Nasmyth, F.L.S., F.G.S.

A fine illustration of the subject is given in the third part of Drs. Heider and Wedl's splendid "Atlas to the Pathology of the Teeth,"* at fig. 110, plate xii., and described as an osseous substance, proliferating into the dentine of a temporary molar in absorption.

I have copied the beautiful lithograph, from which the author's description will be better understood.



"Fig. 110. Lobate prolifications of young osseous substance into the peripheral dentine of roots

* "Atlas to the Pathology of the Teeth," by Dr. M. Heider and Dr. C. Wedl. Leipzig.

of a temporary molar of the lower jaw partly in course of absorption. An irregular hypertrophic layer of cementum was found on the external surface of one root. The longitudinal section shows a nicely defined osseous substance intruding into the peripheral dentine (a, a'). The radiating canaliculi of the bone corpuscles are enclosed by a clear, thin, enveloping layer capsulating them. Sometimes one capsule (b), sometimes two or more, are seen, whereby lobed systems (c) are formed, not unlike the racemiferous glands. The corpuscles are often disfigured like irregular clefts, blended together and irrecognizably obscured in consequence of absorption. The holes, not of rare occurrence in the dentine (as at a'), are also due to absorption."

Fig. 114, in the same plate, shows very beautifully the commencement of absorption of the cementum and dentine in a perfectly sound bicuspid of the upper jaw, with sclerosis of the periosteum of the root; but, I must refer the members for further detail to the Atlas itself, which I presume is included in the library of the Society.

Another most marked, though exceptional instance, is seen in an illustration to Dr. Mitscherlich's paper on "The Replantation and Transplantation of the Teeth," in Mr. Truman's "Archives of Dentistry." In this case, true bone, with its perfect Haversian systems, has filled up the cavities

produced by absorption, and the interesting question arises—Why should cementum be deposited in one instance and true bone in another? I think the question is best answered by Mr. Spence Bate's conclusion, that two distinct structures may be traced between the root of a tooth and the alveolar walls,—the peridenteum and the periosteum, the former producing cementum and the latter bone.* In Dr. Mitscherlich's experiment a dry tooth from a dog's skull was transplanted into the alveolus of a living animal, and, doubtless the peridental membrane was entirely wanting, and after absorption had been brought about by the vascularized periosteum, and arrested by a process of development, true bone was formed in the dentinal cavities, as shown by the illustration referred to.

The process of absorption being so allied to my subject, I may be allowed to remark here, that though the pressure theory is no longer accepted, a certain approximation of the permanent successor to the root of a primary, or of one crowding tooth upon another, would appear to be an absolute necessity if absorption is to be induced; and this is rather enforced by the fact that a permanent tooth is frequently retained in the jaw, whilst the temporary, which it should succeed, undergoes no absorption; further, this nearness, which I believe

---

* *Vide* Mr. Tomes's "Manual," *Opus cit.*, p. 439.

to be essential, may consistently admit of an interlayer of bone, frequently present, between the absorbent papilla and the developing tooth, so thin that the approaching tooth may still excite first the development of the papilla from the intervening vascular membrane, and then its continued action as an absorbent.

The degree of irritation required to induce absorption is difficult to be ascertained. It must, however, be gradual, and is commonly imperceptible as regards suffering, more particularly when either the eruption of the permanent teeth or a crowded condition in the maxillæ is the cause. I believe also that the inflammatory action needed for the development of new cemental pulp, preceding the slow and chronic enlargement of roots, to be comparatively slight; whereas, in a higher state of inflammation, the cementum is more rapidly and extensively developed from its products.

I have recently searched for specimens of inostosis, making numerous sections from teeth in my collection, but in vain. Should, however, these few observations induce others, who have met with examples, to record them, and others to search, and, may be, detect new features, which so often reward investigation, this brief communication will not have been altogether fruitless.

The subject is no innovation of my own, and no one more than myself would deprecate a needless use and consequent confusion of terms descriptive

of slight variations in structural appearances; but, just as "periostosis" has been pronounced by Mr. J. Walker* to be descriptive of the bony layers of exostosis completely encircling a root, and "enostosis" as an appropriate distinction for the more rare abnormal spongy variety, so "inostosis" appears to me faithfully to represent the marked condition of tooth which has been brought forward.

In conclusion, I have only to say, the wish to learn the opinion of gentlemen better versed in dental histology and nomenclature, is my apology for thus occupying the attention of the Society.

---

* "Odontological Transactions," vol. iii. p. 315.

Discussion.

Mr. Sewill doubted whether the term inostosis, if it signified the opposite of exostosis, could be applied to any imaginable pathological condition, and he certainly thought that it by no means indicated the process described in Mr. Henry's paper.

Mr. Coleman considered the subject one of considerable interest, but one which it was impossible to discuss fairly in the short time they had at their disposal. As far as he was able to follow the paper, and the questions therein raised, he believed that they might include, as occurring by the same agency, the absorption of the temporary teeth, also that of ivory pegs, when introduced into bone, with such a case as that especially referred to in the paper. Such absorption appeared effected by the direct agency of proliferating bone-cells, osteo-blasts as they are generally now called. Mr. Tomes had recognized these bodies in the case of temporary teeth undergoing absorption, and had termed them organs of absorption. They not unfrequently themselves underwent ossification in the cavities of the teeth they by absorption had created. Such had been shown by Mr. Tomes to be the case in temporary teeth undergoing absorption; such was shown to be the case in Dr. Mitcherlich's interesting specimen of a transplanted tooth in a dog; and such was, no doubt, the case in that brought under their notice in the paper they had just listened to.

The President thought it a very interesting paper on a most suggestive subject, and one that would lead to profitable results if worked out. He regretted it had been unaccompanied by the diagrams sent by the author, which, for the sake of expedition in publishing the Transactions, had been

put into the hands of the engraver, who unfortunately had neglected to send them to the Meeting.

Mr. Coleman then read his Paper "On Difficulties occasionally met with in the Operation of Pivoting the Teeth:"—

On Difficulties occasionally met with in the Operation of Pivoting the Teeth. By Alfred Coleman, F.R.C.S. Eng. (Exam.) and L.D.S.

Mr. President and Gentlemen,—

Having been solicited by our President to fill up a gap in the proceedings of the Society, I venture to bring under its notice some of the difficulties which I, and probably many others, have encountered in the operation termed pivoting or grafting. This operation is one which cannot be too highly valued both in regard to the comfort it ensures to the patient, with the absence of that serious drawback to the insertion of artificial teeth upon other plans, viz., the injury inflicted upon contiguous sound ones.

It would be foreign to the purport of this communication to describe in detail the ordinary processes for carrying out the operation of pivoting, or to enter upon a description of some of the very ingenious methods which have during the last few years been advanced as improvements upon the older systems; but I think I may with advantage briefly describe the plan I most commonly adopt for the purpose of better elucidating the difficulties I have met with. The insertion of a

natural or mineral tooth—the latter tube or flat according to the bite—armed with a gold pin, into a root plugged with compressed hickory, will I believe be found in the long run equal if not superior to any other plan. I deem it of great importance that the pivot tooth should be accurately adapted to the root which is to receive it, and therefore always take an impression of the latter with some six or more of the adjoining teeth when it has been filed level with the gum, and has had the nerve-cavity properly drilled out. A small piece of wood is inserted into the cavity of the fang before the impression is taken, which is removed adhering to the wax or other material employed, and which in the plaster casting accurately represents in size and position the hole in the fang.

For fine fitting the tooth to the root, I find no plan answer better than placing between the two a piece of the coloured articulating paper, and then removing from either the spots most strongly marked until a very perfect fit has been obtained. With regard to the hickory, I at one time used to insert it into the root, and then drill the hole in it for the pin—a somewhat lengthy process, owing to the compression of the broach by the wood, and a not very certain one as regarded my ensuring the exact centre of the cavity; latterly I have found it much easier to drill and shape the wood before inserting it into the root.

When employing floss silk and mastic in the place of wood, we often fail when the fit is accurate to get the tooth quite home. Increased pressure has to be resorted to from the time of inserting the pin till it is fully pressed up the fang; but in employing the wood, the sensation offered is very different; it appears to grasp the pin with an evenness of pressure from beginning to end, and the tooth slides perfectly home. I am not aware that there is a particle of novelty in the process I have just described, I have either seen or read of all portions of it.

The first of the difficulties to which I will call attention is that arising from extreme sensitiveness in the substance of the dentine of the fangs; it most commonly occurs when the pulp or remaining portions have been destroyed, immediately or through the instrumentality of escharotics. It is often confined to a small spot, and proves, I think, most undoubtedly that the roots of teeth at least may possess a nervous communication from their surrounding periostii. This sensitiveness I have found very difficult to get rid of, repeated applications of arsenic have appeared to produce no effect upon it. About six weeks ago I pivoted a left central incisor, and both laterals of the upper jaw, for a lady of about twenty-one years of age; the crowns were incised, and the pulps carefully destroyed under the influence of nitrous oxide gas; arsenic was applied three times without apparently

lessening the extreme sensitiveness of the fangs, and I could only attain my end by employing strong nitric acid, and then so imperfectly that I could insert but very short thin pins covered with floss silk: as this sensitiveness always disappears in time, I intend on a future occasion to complete the process with longer pins and hickory. Not long since, my partner, Mr. Cartwright, pivoted a tooth for an American gentleman with a hickory pivot. The latter experienced some pain when the pivot was inserted; after a short time, owing no doubt to the swelling of the wood, the pain became intolerable, and he resorted to a country practitioner, who after some difficulty removed the pivot and applied creosote. A fortnight from the time the tooth had been removed, all sensitiveness had disappeared, and was again inserted without pain.

2. Another difficulty, though one fortunately of not very frequent occurrence, is when the root of a tooth is bent or twisted upon itself. I have on more than one occasion, when drilling out the fang-cavity, found my drill, after proceeding no very great distance, to meet with an impediment to its progress, and then, after a short time, suddenly to plunge into soft and sensitive tissue, which has bled freely; but I have never failed in such cases, after arresting the bleeding, to adapt a tooth with a pin long enough to secure a fair hold. Calcification of the contents of the fang-

cavity, and preternatural shortness of the fang, are also difficulties which may be noticed under the same head: the former renders the operation more tedious, and often very painful to the patient; the latter renders it less likely to be successful.

In young subjects, where the operation has a smaller chance of being made a very permanent one, we are very liable to force the breach, or drill through the opening of the foramen at the extremity of the fang, but I have never met with any untoward results from so doing.

3. Fracture of the pin of a tooth that has been pivoted is an accident of no very uncommon occurrence. In the first few cases I met with I was able to cut away so much of the fang that I could grasp and withdraw the fractured wire, but on a later occasion the pin was broken at some short distance from the surface. It occurred to me that with mercury I might soften the gold, and then drill it out. With this object in view I carried some mercury on goldfoil to the wire, left it for a few minutes, and then with a sharp drill speedily removed the whole wire—very much more speedily than I had anticipated. I have adopted the same plan on one or two other occasions, and can strongly recommend it.

4. Incising the crowns of teeth retaining their vitality is a nice operation, and one not unfrequently attended with disagreeable results. In

such cases the saw or file can be employed very sparingly, on account of the painful sensations they produce. We must chiefly rely upon cutting or incising forceps, strong in make and of very excellent steel. You are all, no doubt, aware that Mr. Everard has devised a very perfect form of instrument for this purpose. It consists of two bars of steel shaped like a pair of extracting forceps, and made to cross each other at the hinge in the same way; one of the shorter arms or blades is made similar to the blade of an ordinary pair of incising forceps, but the other drives forwards a strong bar of steel, made sharp at the extremity, which is opposed to the other blade. This arrangement makes a straight incision, and not one representing a portion of a curve, as in the case of ordinary incising forceps, and moreover gives a very increased amount of power. I think it would be an improvement to have the blades chisel-shaped at their cutting extremities, and not curved as Mr. Everard makes them; and I am sure it is an error to have them very sharp; the action should be rather that of a clean fracture than of an incision: when too sharp, the whole force is so expended, and the blades sink into the substance of the dentine without severing it. Mr. Charles Rogers, who has bestowed much attention on the subject we are discussing, has found Everard's forceps of the greatest service. He informs me that he never files or saws the tooth

previous to applying the forceps, but first notches and breaks the enamel with them, and then cuts clean across.

I have to record two disasters occurring at this portion of the operation. In the first case I was removing the crown of a right upper central incisor, the vitality of which was not destroyed; the lady upon whom I was operating strongly objected to inhale nitrous oxide, and at her request the tooth was frozen with the ether spray. This was done so thoroughly that no pain whatever was experienced during the incising or in the removal of the pulp afterwards; but, alas! the tooth was rendered excessively fragile, and split into a number of fragments, which, when removed, left the root some little distance below the level of the gum; fortunately, however, enough of the root remained to enable me to fit a tooth securely upon it. I should be sorry to again employ the ether spray for such a purpose. In my second case the difficulty arose from the size and density of the tooth. In March of last year a lady of tall stature applied to me in consequence of having, during a fall upon the ice, broken across her left upper central incisor just above the pulp-cavity. Attempts to incise this tooth whilst the patient was under the influence of nitrous oxide utterly failed; various cutting forceps were tried, and that constructed by Mr. Everard was fractured across the parallel bar, but without success. The tooth

became quite loose during the operation; so as a last resource I removed it, and in the work-room, with no small difficulty and much rubbing off of the periosteum, sawed it across. I then drilled out the pulp-cavity and screwed into the fang a gold wire, and upon the fang fitted down a tube tooth. When this was completed, occupying more time than half an hour, I returned the root to the socket. The tooth was painful and loose for some days, and projected beyond the line of the other teeth; but in a month's time it was pretty firm, and in three months perfectly firm. Within the last month I have removed the tooth from the pin, which required some considerable force in so doing, and adapted another of a better shape and colour than that I was able to procure at the time of the operation. During the latter process I had ample opportunity for testing the firmness of the root: it was perfectly firm and free from tenderness. By this model of the mouth you will see that the incisors are unusually large.

5. The last of the difficulties I shall bring under your notice are those most common as a result of the operation of pivoting, viz., inflammation occurring in parts surrounding the root of the pivoted tooth. I have hardly sufficient evidence before me to say positively how frequently we may expect it; but I should believe about one in ten to twelve cases will not be very far from

the truth. Under these circumstances I consider it right always to name to my patients the risk they must expect to run. Of the front teeth, the lateral incisors are the most liable to this disaster; why they should be so has not, I think, been explained, although our attention has been drawn to the subject by, I believe, Mr. Longhurst. It is, I know, supposed to arise most frequently in those cases where, prior to the operation, a discharge has escaped through the open orifice of the fang. I believed so myself at one time, but found, upon closer observation, that it occurred more frequently where the pulp had been destroyed, and where no discharge had existed. Lately I have pivoted teeth where there has been a discharge from the root, and without, I believe, any such inflammation occurring. I have, however, taken care to thoroughly clear out the contents of the root, and provide it with a pin that shall leave in it as little vacant space as possible. I am inclined to believe that the explanation given in the "Dental Cosmos," some years ago, of the origin of the discharge in roots where the contents of their cavities have been removed, is the correct one, viz., that it is *liquor sanguinis* that finds its way through the dentinal tubuli from the periosteum; if so, there can be no great danger in arresting its exit at the pulp-extremities of the tubuli.

Mr. Tomes, in both his works, recommends

the removal of a pivoted tooth, in case a sharp attack of inflammatory symptoms set in. He narrates a most interesting case where tetanus followed such an attack. I can hardly imagine that a patient is more liable to this formidable condition after pivoting, than after an extraction or destruction of a dental pulp either immediately or by escharotics; and what we now know of the pathology of this complaint, would lead us to regard the case in question as a purely accidental one. If the patient be endued with a moderate amount of endurance, we may almost always save the tooth; I have not for many years extracted under such circumstances.

The following case, which occurred in the practice of Mr. Cartwright, and which I have the permission from that gentleman to describe, is, I think, a highly instructive one. About fourteen years ago he pivoted an upper central incisor tooth for a lady. Severe inflammation almost at once set in, for which he recommended leeching, and other suitable remedies; being under the care of a homœopath, this course of treatment was not pursued. Six weeks after the pivoting, she presented herself before him, and a miserable object to look upon. Her face was considerably swollen and disfigured, while on opening the mouth, the tooth could not be seen for the pus which flowed over it; it appeared to be floating in this fluid, and could have been most easily

removed between the finger and thumb. Free incisions were made through the gum, over the extremity of the apex of the root, and much pus let out. Other suitable treatment was adopted, and soon a healthy condition of things returned. Since that time most of the adjoining teeth have been lost; but this remains, as I have recently seen it, quite firm, and is very serviceable in assisting to support a plate this lady is wearing.

Discussion.

The President would be very happy to hear any comments on this highly practical paper.

Mr. Harding said Mr. Coleman had not called attention to one fact which had come across his notice in the use of wooden pegs, which, not fitting quite tight, allowed moisture to run down their sides, and so to cause a most offensive smell and disagreeable taste. If the nerve was exterminated, and the apex of the canal then plugged with gold foil, the offensive smell and taste would be entirely prevented. Of course this could not be done where the nerve was dead, unless the necessary treatment had been previously resorted to.

Mr. Weiss had frequently employed a small gold tube similar to the wooden one recommended by Mr. Coleman. Of course it was absolutely necessary that the gold should be perfectly pure, and as soft as possible.

Mr. W. Hunt objected to the use of a wooden pivot, mainly because so much of the tissue of the fang must be sacrificed. He therefore preferred gold; and thought a frequent cause of after-inflammation in the root was due to the fact that the pivot acted as a piston, and drove up a column of air into the root during the introduction of the tooth. To obviate this, he usually used gold tube the size of pivot wire, instead of a solid pivot.

Mr. Sewill could not accept Mr. Coleman's explanation of the origin of the pus which flowed from roots in the condition described in the paper. He thought that passage of the matter from an alveolar abscess through the foramina of the roots would account for the discharge, without making it necessary

to seek for its origin in the transudation—if this were possible—of *liquor sanguinis* through the tissues of the tooth.

Mr. Coleman, in reply, said, if the discharge that came from the pulp-cavity of a tooth was examined, it would be found that it was not pus, but a thin watery fluid, in which, even if examined under the microscope, no pus corpuscles could be found. It was simply a thin sanious fluid of a very offensive odour, devoid of all the ordinary characteristics of pus. It was a septic fluid, which, when detained in contact with living animal tissues, produced those changes in them of which pus was the result. It was, indeed, blood-poisoning on a small scale. He did not say that he had not seen true pus discharged at the pulp-cavity of a tooth, but what he maintained was, that in the cases in question the discharge was not at all like pus, but that when it was brought into contact with healthy tissue, pus was secondarily produced.

In reply to the remark made by Mr. Harding, he could not say that he had met with any cases where offensive smell had arisen from the employment of wooden pins. He thought, if they were carefully inserted, it was hardly probable that such could be the case, as, when well compressed, they were so little porous. With regard to the objection, on the score of the great loss of tissue, he might say, that if they could always depend upon their patients coming to them upon the very first indication of a pivoted tooth becoming loose, they might do the operation without wood in the beginning, and reserve that for such second visit. He had done so in some cases, but most of those who did return had done so after much injury had occurred to the root. He thought those were the only points to which he need reply.

The President had only to present the thanks of the Society to Mr. Coleman for his very interesting and valuable paper; to those gentlemen who had joined in its discussion; and also to Mr. Henry for his paper, which displayed so much scientific research. The discussion on Mr. Coles's paper, read at the last meeting of the Society, must, he thought, the time being now so far gone, be deferred till the next meeting of the

Society, which would take place on the second Monday in January, when the Annual General Meeting would be held. That would afford an excellent opportunity for the discussion of Mr. Coles's paper, as it was not usual to have papers read on that occasion.

In accordance with the authority vested in him, as President, he had to nominate two auditors, to audit the Society's accounts for the year, and he therefore selected Mr. James Parkinson and Mr. Barrett. The business of the evening being concluded, the President adjourned the meeting to the 8th January, 1872.

ANNUAL GENERAL MEETING,

Monday, January 8, 1872.

JOHN R. MUMMERY, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The President announced that the ballot was open for the election of the Council and Office-bearers for the coming year.

Mr. Edgelow, M.R.C.S., signed the Obligation Book and was duly admitted a member of the Society.

Mr. Fletcher presented to the Museum a specimen of vulcanite teeth mounted on tortoiseshell.

The Secretary read the list of Benefactions to the Society for the past year.

Mr. Coleman had been requested by Mr. Palmer, of Cheltenham, to show to the Society a somewhat bulky set of artificial teeth, worn by a lady patient of Mr. Palmer's. They were certainly of very extensive dimensions; the cast of the "bite," which he would put before the meeting, would best show the great amount of loss by absorption which had had to be supplied.

The President would like to know the actual weight of the set.

Mr. Coleman.—Mr. Palmer stated the weight to be $5\frac{1}{4}$ oz. He (Mr. C.) thought it should be stated, for the credit of the constructor, that the upper plate, as the spring was

very weak, was chiefly supported by suction. The springs were, he thought, No. 7.

Mr. Coleman had another matter to bring under the Society's notice. Most of them felt, in operating under the influence of nitrous oxide, a difficulty when extracting teeth from the lower jaw, through the tongue getting over the teeth operated on. The instrument in his hands obviated that difficulty, as the cradle under the lower surface of the spring kept the tongue down. Another point in it deserving special attention was the little nut which retained the spring within certain limits, preventing its being too much compressed, and as also enabling the operator to remove it more readily from the patient's mouth. This ingenious instrument was devised by Mr. Merson, a student at the Hospital. He had used it on two or three occasions, and might say that it quite answered the intentions of its originator. (Before he sat down, he wished to make one slight correction. He had stated at a previous meeting that the contents of the bottle sent for exhibition by the Messrs. Barth contained thirty gallons of gas. He should have said twenty-five gallons.)

The President thought Mr. Merson's invention a very ingenious mode of getting over a serious difficulty.

Mr. Steele wished to call the Society's attention to a successful case, bearing upon the subject of a most interesting paper read at a previous meeting, on Reimplantation, by Mr. Coleman. He had a tooth of his own extracted by Mr. Rymer with great care: there was therefore only slight laceration of the gum and no straining of the process. The tooth was in an exquisitely sensitive condition, from the exposure of the pulp, to the slightest thermal changes. On the extraction of the tooth under the influence of the nitrous oxide gas, the dental canal was cleansed, caries removed from the crown, stopped in the usual way, and the tooth at once replaced in the socket.

The President inquired the length of the operation?

Mr. Steele.—The operation lasted about half an hour—the tooth was replaced at five o'clock P.M.; for three or four hours there was a dull aching pain, after which time it gradually lessened, until by noon on the following day pain had entirely ceased. It was, however, still very painful on concussion with the antagonizing tooth. At the expiration of a week this unpleasant symptom had much decreased, and in less than a fortnight it was capable of fulfilling all the functions for which it was intended.

The President.—How long since was that?

Mr. Steele.—It was on the 23rd of December last.

The President.—No suppuration had taken place?

Mr. Steele.—There had been no suppuration, and very slight inflammation.

The President.—Nor at the apex of the root?

Mr. Steele.—It may be said to have healed by first intention. Had there been disease at the periosteum, he would have adopted Mr. Coleman's plan, and removed the affected part, but the root was perfectly healthy. He wished also to say that he considered the Society was much indebted to the gentleman for the paper referred to, and he (Mr. Steele) anticipated the time when the operation of reimplantation would be extensively practised. He hoped other gentlemen would be disposed to test it.

Mr. Charles James Fox wished to know what was the tooth that had been referred to?

Mr. Steele.—The upper left canine.

The Treasurer read the financial statement for the year ending October 31st, 1871, which showed that the receipts for that year were £385. 11*s*. 4*d*., and the expenses £377. 11*s*. 1*d*.; and that the total assets of the Society, down to

that time were—cash £296. 15*s.* 4*d* ; stock in the New Three per Cents, £729. 10*s.* 2*d.* He also stated that the number of subscribing members was—resident 88, non-resident 155—making a total of 243 ; in addition to which there were 23 corresponding, and 24 honorary members ; and that the number of new subscribing members elected during the year was 12, and corresponding 1, while those lost from resignation and other causes was 4.

The CURATOR presented the following Report :—During the past year additions and alterations have been made in the glass cases of the Museum, securing the better arrangement and display of the specimens contained in them.

The entire contents of the Museum have been, for the first time, methodically arranged, and a catalogue, which is now in the printer's hands, prepared.

Numerous donations have been made to the Museum, some of which are of great interest, and the following specimens have been purchased for the Society, for the Comparative Odontological Series :—

Skull of Caffir.
,, Orang-Outang.
,, Moschus Moschiferus.
,, Atales (Spider Monkey).
,, Phoca Greenlandica.
,, Coati Mundi.
,, Nycticebus Javanicus.
,, Gymnura Rafflesii.
,, Centetes.
,, Hemicentetes.
,, Six Bats (species uncertain).
,, Capabara.
,, Goat.
,, Pteropus.
,, Kangaroo.
,, Petaurista.
,, Phalangista Vulpina.
,, Armadillo.

Skull of Hydromys.
,, Puff Adder.
,, Diodon.
,, Boar.
,, Monkey (diseased).

The expenses incurred by the Society, during the year, on behalf of the Museum, were £29. 12*s*. 6*d*.

He had received a letter from Dr. Bellisario, of Sydney, announcing the presentation of a large and very valuable collection of specimens from the Museum at Sydney, which, if the vessel duly arrived, would be in the possession of the Society in about a month's time.

The PRESIDENT stated that in addition to the foregoing list he had hoped by that time to have received a collection of valuable skulls from Mr. Broadway, of Cairo, but unfortunately an accident had happened, by which most of them had been irreparably injured. He had much pleasure in informing the members that Mr. Broadway had promised another set of specimens, which he trusted would soon be in the Society's Museum. The President had a fine skull of the hippopotamus, which he would have much pleasure in presenting to the Society.

The PRESIDENT stated that the Librarian had not furnished any report from his department; but it was the intention of the Council to devote the same care to the re-arrangement of the Library during the coming year which had been so satisfactorily devoted to the Museum during the past year.

The PRESIDENT announced that the following gentlemen, recommended by the Council, were elected as Officers and Council for the year 1872; Mr. Coleman and Mr. Bennett acting as scrutators of the ballot.

President.—Thomas Underwood, Esq.

Vice-Presidents.—Resident: Alfred Canton, Esq.; Isaac Sheffield, Esq.; Edwin Sercombe, Esq.—Non-resident: Joseph

Snape, Esq. (Liverpool); John A. Baker, Esq. (Dublin); Peter Orphoot, Esq. (Edinburgh).

Treasurer.—W. A. Harrison, Esq.

Librarian.—Thomas A. Rogers, Esq.

Honorary Secretaries.—G. Gregson, Esq. (Council); T. Henry G. Harding, Esq. (Society).—For Foreign Correspondence: Charles James Fox, Esq.

Councillors.—Resident: John Tomes, Esq., F.R.S.; Samuel Cartwright, Esq.; G. A. Ibbetson, Esq.; W. F. Forsyth, Esq.; Robert Ramsay, Esq.; E. H. King, Esq.; James Parkinson, Esq.; Joseph Rogers, Esq.; E. J. Winterbottom, Esq.—Non-resident: H. Barron Rodway, Esq. (Torquay); S. Clifford Gibbons, Esq. (Brighton); G. S. Williams, Esq. (Clifton); J. H. Martin, Esq. (Portsmouth); J. K. Chisholm, Esq. (Edinburgh); Daniel Corbett, Esq. (Dublin).

The President then invited the members present to discuss the paper read by Mr. Oakley Coles at a recent meeting, on the Celluloid Base. The discussion had been unavoidably postponed until the present meeting, but he hoped it would not be the less close and searching on account of the delay; the subject being one of great interest in the daily life of the practising dentist.

Mr. Fox remarked that he was able to say so little upon the subject of Celluloid Base that he only rose in the hope that his few words might induce others to say more. He must first express his obligation to Mr. Oakley Coles, to whose courtesy he was indebted for his first instructions in using this new material. The good results he had seen turned out in Mr. Coles's work-room caused him to form a more favourable opinion of the new base than he had previously conceived from the report of others; still he was inclined to wait for more increased experience before forming a definite opinion. He had used it experimentally in two cases of regulation, and after two months' wear had observed no change in the plates. It would be useful in such cases, inasmuch as a first plate could be readily altered to any changed positions of the

teeth by merely re-pressing it in a fresh cast. He had not yet tried it as a base for artificial teeth, but as far as working it was concerned, he could say he had seen several most satisfactory cases turned out in Mr. Coles's workroom. In a case where it was desired to fill up a very high palate he had found its extreme lightness most serviceable. In such cases he had been able to use up several pieces left from other cases, merely scratching the edge well with the saw. When pressed, no point of union could be seen, and, as far as *appearances* went, the whole formed one perfect mass. He would ask Mr. Coles whether his continued experience with this material justified the confidence he had at first expressed in it—whether he still continued to prefer the use of water to oil? It certainly was more cleanly to use; but several had expressed a very decided opinion that it did not produce such good results as oil did, and attributed many of the failures which had occurred to the non-use of oil. He had seen Mr. Coles use milk as a sort of compromise between water and oil, and would like to hear if Mr. Coles had tried it further, and with what results.

Mr. Oakley Coles had found, by experience, a confirmation of all he had stated two months ago. In this material we had something very admirably suited for dental purposes. In the whole of the cases he had only had one that had failed. That was a complete failure, as a piece broke away, and two teeth came out of their sockets; but that was due entirely to an imperfect combination of the gun-cotton with the camphor. That was really the reason. They did not take sufficient care in America to combine the two together; and so when it was worked up there was a white patch, and at that point failure took place. He had never had any difficulty arising from the warmth of the mouth. It was always sufficient if the celluloid was in contact with it to keep it from warping, and if there was a continuous line following the alveolar ridge there was very little danger of its warping; but if it was placed on the table, or taken out of the mouth, it would warp. If, however, when the teeth were taken out at night, they were placed (as was the rule) in water, they would keep all right, and there

would be no trouble whatever in fitting them in in the morning. He still continued to use water in the preparation of the material: milk produced a tougher result, but he had discontinued it, as it was not so clean as water. There was no doubt that the material was very imperfect—what was wanted was a much better material with the same characteristics. They all knew the difficulties that occurred in the early days of vulcanite, and that it was not until there was some degree of combination that something like good results were produced; and if some of our English depôts or manufacturers would take up the celluloid base they would get a material very much better than vulcanite in every respect. Besides, its lightness of colour gave a freshness and vitality to the teeth. With black vulcanite they got a peculiarly dark and dense appearance to the tooth, which was quite unsatisfactory; but with this material a bony, transparent, and vital appearance was obtained which was highly satisfactory, not only to the patient, but also to the dentist. He could only trust that it would have a fair trial. They did not in this country give everything sufficient trial. There was great reluctance to take up a new thing, and in this matter everybody had been waiting for everybody else. There were various commercial interests that had tended to check its introduction into this country. It was American; it was patented all over the world, which was at once a check; and there were other interests which it was not necessary he should enumerate; but if a large number of persons would take it up and give it a careful investigation, they would soon have another valuable material added to their stores.

Mr. Charles S. Tomes read the following paper:—

Description of an Odontome. By Charles S. Tomes, Curator of the Museum.

Mr. President and Gentlemen,—

I propose to call your attention to a specimen which has been for some years in our museum, but which, although of extreme rarity, there being only three* other similar forms of tooth-tumour recorded in the most recent works on the subject, has not hitherto been fully described.

This tooth tumour, or Odontome, was presented to the Society by Mr. Hare, of Limerick, and was figured and described in the Transactions,† where

* Notice of the other examples of this form of tooth-tumour will be found in the following works :—1. "Des Anomalies Dentaires, et de leur Influence sur la Production des Maladies des Os Maxillaires," par A. Forget. Paris, 1869. Plate II., figs. 1 & 2. The same specimen is more fully described in "Traité des Tumeurs," par Prof. P. Broca. Paris, 1869. Tome deuxième, p. 364.—2. "Atlas zur Pathologie der Zähne," von Prof. Dr. M. Heider und Prof. Dr. C. Wedl. Leipzig, 1868. Erste Lief., Taf. II., fig. 28 und 29.—3. (Spec. 1022, Museum Royal Coll. of Surgeons) "Guy's Hospital Reports," Series 3, vol. xiv., 1869. S. J. Salter.—Art. "Diseases of the Teeth," p. 351, by S. J. Salter, in Holmes's Dictionary of Surgery.

† "Transactions of Odontological Society," vol. iii. p. 335, 1863.

it was spoken of by my father as an exostosis. Shortly afterwards, Mr. Coleman, dissenting from the view that it was an exostosis, on the ground that it was hollow, expressed an opinion that it might be a calcified cyst;* and, more recently, Mr. Salter, writing in Holmes's "Dictionary of Surgery" (*loc. cit.*), gave to it, in common with the other specimens alluded to, the name of "Hypertrophied Dilated Fang."

With the view of settling the disputed point as to the real nature of the tumour, I have lately made sections through it in two directions: one section passing vertically through the crown and roots of the tooth which surmounts the mass, and the other passing through the rounded lobe furthest removed from the tooth.

It will be superfluous for me to describe here the external characters of the specimen, as these have been detailed in the Transactions already (*loc. cit.*), but the original woodcut has been reproduced here to render the direction of the sections more intelligible: this drawing is of the natural size of the object.

Fig. 2 shows the position of the sections made. The microscopic section (fig. 3) was taken along the line *a b*; along the line *b c* the tissues displayed were, on the outside, a thin layer of

* "Transactions of Odontological Society," vol. iv. p. 4, 1865.

cementum; next to this, a layer of dentine; and within this, a solid mass of bony tissue.

FIG. 1.

FIG. 2.

The section marked *d d* exposed only the irregular bony tissue, with its covering of cementum; no dentine was found here, even on microscopic examination.

To the naked eye the section through the tooth reveals the following appearance:—At the top is a tooth which, but for its fangs being rather small in proportion to the crown, is of tolerably normal form; the fangs are well defined, but in place of being free, they are embedded in an osseous mass, which, at a short distance below them, expands out to form the lobulated tumour.

The first great lobe is seen to be bordered by a

thin shell of whitish, translucent-looking tissue, the interior of which is filled up solid with a tissue having, to the naked eye, very much the appearance of the secondary dentine which is found in the pulp-cavities of elephants' teeth, obliterated in consequence of the irritation of a foreign body.

A microscopic examination confirms the conclusion which would have been arrived at from a

Fig. 3.

naked-eye examination, namely, that the fangs display, on a somewhat reduced scale, the structure of those of a normal tooth. The section has, unfortunately, not exactly passed along the pulp-cavities of the fangs; but the dentinal tubes radiate outwards to the periphery with great regularity, and the granular layer of the dentine is unbroken and continuous all round their surface. The outer

layers of cement which coat the fangs at the neck of the tooth, are continued round the outer surface of the whole tumour, thus indicating that the whole mass was contained inside the tooth-capsule; while some layers are reflected inwards, and form a covering to the inner surface of the fangs.

The great bulk of the growth, which is solid at its upper, and more or less hollowed out at its lower portions, is made up of an irregular bone-like tissue, with—especially in the neighbourhood of the tooth—indications of contorted stratification. At a little distance from the tooth, at the right-hand lower corner of the figure, is seen a thin band of dentine, running parallel to the surface of the tumour, and overlaid by a few layers of cementum. This is the upper edge of that shell of dentine, previously alluded to as forming a coating round the upper of the two great lobes; from the lower lobe it is entirely absent,—at all events, where the section has been made.

The dentinal tubes in this shell of dentine run, as a rule, in a direction perpendicular to the surface, though at the free edges of the shell they are rather irregularly disposed; the internal surface of this dentine shell is in many places hollowed out by those sinuous concavities generally held to be the result of absorption: these are everywhere filled with bone-like tissue, so that the interior of this shell presents very much the appearance of the figure copied from Heider and

Wedl, by Mr. Henry, in the last month's Transactions.

The study of these sections must, I think, lead to some alteration in the views which were expressed on the nature of the tooth-tumour after an external examination, before any sections had been made of its substance; in face of the facts which these sections have disclosed, it can hardly be considered either as an exostosis or as a calcified cyst. For the presence of a layer surrounding, like a shell, a considerable portion of the mass, shows that the whole must, in the first instance, have been a dentinal pulp, in which, for a time, the normal process of calcification went on at the surface, so as to form a skin of dentine, but afterwards gave place to a form of calcification leading to the production of a bone-like substance, in parts not unlike secondary dentine, blocking up the interior of the shell.

The question then arises whether we should adopt the name given by Mr. Salter (*loc. cit.*), viz., "Hypertrophied Dilated Fang;" this name being based on the appearances presented by a specimen in the museum of the College of Surgeons, in which the only section made lies, like the second section * spoken of in the tumour under consideration, far away from the fangs of the tooth; hence the relations of the morbid growth (which is seen

---

* Fig. 2, *d* . . . . *d*.

to consist of a shell of dentine surrounding a bone-like tissue) with the fangs of the tooth is not at all shown.

And as far as can be learnt from their figure, the specimen recorded by Heider and Wedl has been treated in the same manner, so that nothing can be learnt from it of the condition of the fang. In the case recorded by Forget, one of the three fangs is slightly deformed, the other two remaining normal; but it could by no means be said to be "dilated;" it is rather crushed, and, moreover, no shell of dentine encircles the tumour; in fact, Prof. Broca (*loc. cit.*) states distinctly that no dentine enters into the constitution of the mass.

The use of the term "hypertrophied dilated fang" would lead to the inference that the whole mass took the place of, or, more strictly speaking, actually was one or all of the fangs of the tooth. Now, such a view is not at all borne out by the specimens examined: in two out of the four described by recent authors, nothing whatever is known of the fang, whilst in the remaining two the fangs are seen to be fairly regularly developed, and neither "dilated" nor "hypertrophied."

The use of the term, therefore, seems to me undesirable, as it is descriptive of a state of things which, indeed, possibly may occur, but which has not yet been demonstrated in any specimen, and which certainly does not exist in the only two which have been fully examined.

Prof. Broca, in whose work is a most exhaustive and instructive account of odontomes, does not appear to have met with a precisely similar case, but he has provided in his classification of these bodies for its occurrence, and he would term it an "Odontome Radiculaire Dentinaire" (*op. cit.*, p. 300); that is to say, a tooth-tumour resulting from an outgrowth from the formative dental pulp, *at a period when the fangs were already in great part complete.*

This offset of the pulp and the dentine resulting from its calcification, may or may not retain its primitive connection with that part from which it springs; in the present instance, the true dentine constituting the shell is not seen to be in continuity with that of the fang, but it approaches very nearly to it at one place: at this point, however, the direction of the tubes in the normal and abnormal portions is such, that it does not suggest their fusion at any point in that immediate neighbourhood. However, even though there be actual continuity at some unseen part, this does not greatly affect the matter, for no one can doubt that the pulp which by its calcification constituted the tumour, was derived from the pulp of the tooth; the reason that the name "Odontome Radiculaire" is preferred, being that it is descriptive of the origin of the tumour, whereas the term "Hypertrophied Dilated Fang" indicates a state of things which has never yet been demonstrated.

Discussion.

Mr. Coleman thought the subject too interesting to be passed over in silence. He was ready to admit that Mr. Tomes's inquiry proved almost conclusively that the specimen was not a calcified cyst. It possessed considerable interest in regard to the formation of osseous tissue in close proximity to dentinal tissue. In some of the teeth obtained from ovarian tumours he had found bone and dentine mixed together without any apparent arrangement, and moreover, many of those teeth were wanting in pulp-cavities. He might add that they need not be greatly surprised to find tumours containing dentine in parts where that structure was commonly met with—indeed it was only following the rule which applied to tumours generally. The more recent views respecting the development of dentine showed the existence of odontomes easy of explanation. They were much indebted to Mr. C. Tomes for having demonstrated the true nature of this remarkable pathological specimen.

Mr. C. Tomes wished to add an explanation taken from the work of Professor Broca already alluded to, as accounting for the structural characteristics of this and similar tumours. He supposed that the whole abnormal mass was at one time a huge dentinal pulp: that for a time its normal process of calcification went on, forming the shell of dentine; but that, from some disturbing cause, the layer of dentine-forming cells known as the "Membrana eboris," or "Odontoblast" layer, became either destroyed or dislocated from its proper position. After this has happened, the continuance of the formation of true dentine is impossible, as he maintains that these characteristic cells, once destroyed, can never afterwards be reproduced: hence the interior of the shell is filled up by an osseous mass of irregular structure.

The President then read the following Address:—

Gentlemen,—I feel that it is a difficult undertaking to follow, with a suitable valedictory address, the long line of my respected predecessors in this chair. They have so well expressed nearly all that could be said on the past, the present, and the future of our Society, that it is not easy to make observations equally appropriate and original.

It was my privilege, as a non-resident member, to attend the first meeting of the Odontological Society, in George Street, Hanover Square, and to hear the admirable address of our deservedly honoured first President. I well remember the contrast which Mr. Cartwright drew between the state of our profession at the time of his earlier recollections, and the advance already made when this Society was inaugurated. He remarked that formerly dentists were few in number; their acquirements, too often of very limited character, and their instruments of the roughest description; but that he rejoiced that he had lived to see a great change in the state and prospects of the profession.

It may be boldly asserted that the objects which the founders of our Society set before them have been nobly realized; and if we note the progress made during the past sixteen years, we have abundant cause to congratulate ourselves on the success which has resulted from combined effort. Many provincial districts which (at the commencement of that period) were occupied by itinerant dentists, are now supplied with intelligent, educated, and thoroughly competent practitioners—a change which, directly or indirectly, is largely attributable to the influence of the Odontological Society.

Let us take encouragement from the past; let our motto still be "*Onward!*" and, not content with present attainments, let us strive to make the line of demarcation yet more clearly defined between competent practitioners and those who cannot truthfully be so designated.

I noticed, on another occasion, that during the palmy days of old Greek and Roman civilization, the empiricism of the

oculists attained a height which is not even surpassed by modern advertising dentists.

The nature of the imperfection of sight in advancing years, consequent upon the flattening of the crystalline lens, was not at all understood; and spectacles being wholly unknown, numberless remedies, promising rejuvenescence, were devised, all being, of course, worse than useless.

Yet, ophthalmic surgery now takes a high position, and let us hope that our younger brethren will live to see our speciality occupying an equally honourable place in the public estimation.

It was my aim, in seeking for papers to be read before the Society, to secure a due proportion of practical and scientific subjects; but those only who have tried, can fully understand the difficulty of obtaining promises (for particular dates) which can be relied upon. An eminent surgeon hoped to furnish me with a paper which would have been very valuable to us, but he found it out of his power to spare time for its preparation. I am, however, glad to announce that another paper of the highest practical interest is only postponed, and will be read during the current session.

Our meetings have usually been well attended, and if some papers have not elicited extended discussion, it has been on account of their strictly scientific character, as they treated of subjects unfamiliar to the greater part of the audience.

Nevertheless, I believe firmly that, independently of their intrinsic value, they will suggest subjects of study to many of our younger members, and will, I hope, stimulate them to find in Odontology, in the widest acceptation of the term, a source of interesting and profitable intellectual occupation.

In taking a cursory view of the several papers read before the Society, I have to mention an admirable paper of Mr. Charters White, on the Minute Anatomy of the Pulps of the Teeth, and am happy to find that a gentleman whom I have long known as an able microscopist, has given us a paper, in which he has so well worked out a difficult and much disputed subject.

A paper was read by Mr. Fox, on the "Extraction of Teeth," comprising, within brief compass, an excellent review

of the present system of performing that operation, and it elicited a considerable amount of animated discussion, which could not fail to be profitable to the Members.

In April, Mr. Cattlin read a paper, embracing a wide range of subjects, on "The Difficulties and Accidents attending the Practice of Dental Surgery." The paper was a very elaborate one, and was very profusely illustrated by engravings; but, owing to circumstances to which I need not more particularly refer, a very limited discussion took place upon the paper. I may, in passing, remark that an unfortunate delay took place in its publication, owing to the time required for engraving the illustrations and from other hindrances, and that thus the issue of the succeeding numbers was retarded — a matter which was beyond the control of the Publishing Committee. I think it due to the members, that this explanation should be given for a delay which was a subject of reasonable complaint from many members, and of sincere regret to the Publishing Committee.

In May, Professor Flower favoured us with a very interesting paper on a curious and little-known subject,—"The Temporary Dentition of the Mammals." Upon a branch of Odontological science so little familiar to us, extended discussion could not be expected; but I hope that many of our younger brethren will be stimulated to carry out an investigation which is still far from complete.

In June we were privileged with a paper from Professor Rolleston, on the "Development of the Enamel in the Teeth of Mammals," illustrated by the evolution of a molar tooth in a young elephant, and in the incisor of a fœtal calf; the great advantage of being able to witness the various stages of growth on so large a scale was made evident by the Professor's highly instructive explanations, and we must all feel deeply indebted to him for having thus enriched our Transactions.

In November, Dr. Langdon Down read us an admirable paper on "The Relation of the Teeth and Mouth to Mental Development." This subject is an eminently practical one to us, taking into account our extensive opportunities of observing the varied forms of the Dental Arch; and I have every

reason to believe that our members may be able to furnish Dr. Down with data which will supply matter for most interesting discussion. I therefore trust that every opportunity will be taken by members to preserve a record of cases bearing upon this important question. Dr. Langdon Down's paper was followed by an admirably practical one upon the Celluloid Base, by Mr. Oakley Coles, to whom the Society is greatly indebted for his patient and extensive experiments with this new and somewhat curious compound. The new base has not yet been extensively employed in this country, owing, in a great measure, to the inventors having made this material the subject of a patent. Meanwhile I feel assured that no member of the profession is able more zealously or efficiently to carry out observations on the subject than Mr. Coles.

In December a paper by Mr. Henry was read, on Inostosis, which is highly creditable to his scientific research, and I am happy to find that in the Transactions a deficiency has been supplied which was felt during the reading of the paper, by the insertion of two excellent illustrations.

On the same evening Mr. Coleman read a valuable paper on the difficulties met with in pivoting teeth, a paper containing many practical hints which cannot fail to be appreciated. An interesting discussion followed and useful observatons were elicited on the subject.

My comments upon the work of the session would be incomplete without some notice of the various casual communications which have been made during the session. Among these may be mentioned the instructive remarks of Mr. Sercombe, on the use of the India-rubber Coffer Dam; on the improved Illuminator, by Mr. Stevens; on the Mallet, by Mr. Kirby, Mr. Hutchinson, and other members; and by Mr. Balkwill, on Pivoting teeth. Most valuable suggestions have been made through this channel of communication. In several instances we have had very useful discussion, and all have been benefited by the free interchange of thought and experience.

In order to promote the study of Dental Histology among the members of our Society, the Council obtained the invaluable

aid of Dr. Lionel Beale, who delivered a most interesting course of lectures upon Practical Microscopical Research. Those gentlemen who availed themselves of the privilege thus afforded, have, I trust, in some instances, been inspired with the love of a pursuit which I can affirm, from past experience, to be one of the most fascinating that modern science can supply.

The Treasurer has displayed his accustomed zealous interest in the affairs of the Society; and I take this opportunity of recording my especial obligations to the Secretaries for the valuable assistance they have afforded me in the discharge of my anxious duties.

For a considerable time past, the library has been in an unsatisfactory condition, no report having been presented by the Librarian for the past year; but I can now congratulate the members on the acceptance of the office by Mr. Thomas A. Rogers, a gentleman whose name is a guarantee for the conscientious fulfilment of any duty he may undertake.

It is also a matter of satisfaction that the office of Curator of the Museum is now so efficiently filled by Mr. Charles S. Tomes, who is specially qualified, by his attainments in the science of Comparative Anatomy, for his duties. May we not hope that members will avail themselves of every opportunity to enrich the Museum, which might thus become one of the most perfect special collections in the United Kingdom.

My respected predecessor was called on to record the deaths of six members during his official year; happily, it is my lot to name one only,—the late Mr. Haslam, of Berners Street, a gentleman whom I had not the pleasure to know personally. He was compelled, by the state of his health, to spend much of his time in the country; and I have heard that, although little known to the Society, he was a highly respectable practitioner.

One member has been expelled, and five have, from various causes, resigned their membership. Twelve new members have been admitted, thus leaving an increase of five members at the end of the year.

It now only remains for me to thank you cordially for the

kind support you have always given to me in my responsible position, and I venture to hope that, in the discharge of my duties, you will give me credit for having had the welfare of our Society at heart, and having, amidst occasional difficulties, striven, to the best of my ability, to preserve the harmony and promote the interests of our Society.

It is not without emotion that I take my leave of you as your President; but I shall never cease to feel a lively interest in all that concerns the efficiency of a society which has already achieved such eminently successful results to the profession, and not less to the community at large.

In conclusion, I wish you all a most happy, prosperous, and useful career, under the auspices of my esteemed successor, throughout the year upon which we have entered.

Mr. Barrett remarked there was one subject of interest which remained to be brought under their notice. He was confident they would all join in a unanimous vote of thanks to their President for the thorough manner in which he had carried out the duties of his office, to the great advantage of the Society. Were other proofs wanting, they might be found in the interesting farewell address just delivered, in which reference was made, not only to the various papers read by members of this Society, but to the services of other eminently scientific men which had been obtained, and thus had added largely to the accumulation of highly interesting information. Every past President knew how great was the difficulty to effect all this. The lateness of the hour prevented him from saying more than to offer the unanimous thanks of this Society to their late President.

This was carried amidst applause.

The President felt they had been pleased to give him an amount of commendation to which he really felt he was little entitled. He had simply tried to do his duty. There had been imperfections on many points which he would gladly, if possible, have amended. He had striven to promote the welfare of the Society in all its aspects, and if he had been found worthy of their confidence he felt sincerely gratified.

Although it was now his painful duty to bid them farewell as their President, it would always be his earnest endeavour, in his private and individual capacity, to promote the welfare of the Society, which would, he trusted, flourish in the coming year, under the presidency of his esteemed successor.

Mr. Cattlin wished to propose a vote of thanks to the Executive of the Society for their valuable services during the past year. He was more particularly anxious to do so, to show that there was not, at the present time, any kind of "misunderstanding" between himself and the Council, and he was not aware that a misunderstanding had ever existed, although it had been so stated in a letter published in the August number of the "British Journal of Dental Science," and officially signed. As his paper had been alluded to by the President, he would say that everything was done on his part to expedite its publication. At first a few difficulties had to be overcome, arising out of questions respecting the copyright of the paper and other matters (to which he would not now more fully allude); but it was a fact that the large lithograph plates could not be obtained from their printers till within a week of its publication. He (Mr. Cattlin) was sure the new Council would excuse him if he called their earnest attention to the imperfect state of the law relating to the copyright of papers which were read before the Society. He thought it would be a very unwise and unjust policy for authors to be deprived of all interest in their own work; and it would be equally unjust if the Society had not the right to publish and republish such papers in their Transactions, in such manner and as often as the Council should think fit. No injury was likely to arise to the interest of either party if they had a joint copyright, and perhaps that would be the most equitable arrangement. As the matter now stood, the subject was not even referred to in the laws of the Society, and the members had not the slightest power either to initiate an alteration of an old law, or to introduce a new one, even at the annual meeting. On that account he had ventured to make the preceding suggestions, and he hoped all present would now join him in thanking the Executive most heartily for their past services.

The PRESIDENT wished the subject of copyright had not been brought before the Society, but left, as he believed, had been the practice since the origin of the Society, with the Council. He might add that, having contributed himself various papers to the Society during the last twelve years, he had never, on any occasion, experienced any difficulty in having such verbal alterations made as he deemed desirable; but he had always regarded this privilege rather as a permission than a right. He would suggest that Mr. Cattlin should address himself to the Council on the subject.

Mr. Fox wished to draw Mr. Cattlin's attention to the fact that the 59th Law distinctly provided that the suggestions of a member should be made to *the Council*, by letter addressed to the Secretary.

The Meeting was then adjourned until Monday, the 5th of February, when a paper would be read by Mr. Oakley Coles on the Production of Articulate Sounds (Speech).

GENERAL MONTHLY MEETING,

Monday, February 5, 1872.

THOMAS UNDERWOOD, Esq., President, in the Cha

The Minutes of the last Meeting were read and confirmed.

The President then read his inaugural address :—

Gentlemen,—In accordance with the now historic custom of this Society, I have to offer you a few remarks on entering on the duties of my office. The honour of being your President is the highest a man can receive in our profession, and one requiring greater call on your kindness than I feel I can lay claim to. Let me therefore, first of all, beg you to accept my earnest thanks for electing me to this important post and to assure you I will endeavour, to the utmost of my power, to justify your choice; while, at the same time, I cannot but realize the great responsibility that rests on the holder of the office. Among the characteristic features of the scientific societies in our country are :—an especial tone of dignity, a marked obedience to law, and a desire to strengthen the hands of the executive as long as power is judiciously exercised. How imperative is it, therefore, that one who, by the suffrages of his compeers, has been placed in the position you have been good enough to award me should use the utmost caution and forethought in every step he takes.

The Odontological Society possesses and exerts a great and weighty influence, not only in the profession in this country, but also on all who follow it throughout the world. Your President is therefore called upon to be ever watchful and alert that nothing which can affect its interests, nothing which can in any way tend to its advancement may escape his notice; he must uphold the dignity of the profession whose representative, to a certain extent, for

the time being, he is; he must endeavour to procure for your investigation, criticism, and instruction, papers of interest; and above all, he must sit as an impartial judge on all matters brought before him. Such serious duties may well nigh deter a man from accepting such an honour, but in the case of our Society there has ever been so kindly and chivalrous a feeling shown to those who have occupied this chair—so earnest a desire to sink private feeling in the general good, to consult rather the welfare of our body at large than personal gratification—that the necessary and wholesome anxiety experienced in entering on these important duties is materially lightened.

When this Society was founded in 1856, its originators felt that combined action was necessary to place the profession in its proper position; to attain this combined action, mutual forbearance to no ordinary extent was required. The history of the movement, which has resulted in so great success, shows that this mutual forbearance was largely exercised and remains to this day—and long may it remain—a marked feature in those who practise our speciality in surgery.

Much has been done in these intervening years. The two parties into which the dental profession was split have become one. The number of our members has steadily increased. There is a general feeling of unity, and a recognition of the Society as the representative of the profession in the United Kingdom, even by those who are not enrolled in our list. A sister institution, the Odonto-Chirurgical Society, has been successfully established in Edinburgh; we have obtained a recognition on the part of the State by legislative enactment of Dental Surgery; the Dental Hospital of London, and the London School of Dental Surgery have been established on firm bases, and are working most admirably. This surely is a satisfactory retrospect, and an ample reward to those whose time and energies were so ungrudgingly given to the good cause sixteen years ago. To the two separate parties who agitated for the good of our body in '57, and who are happily now united, and to you as members of the Odontological Society, s mainly, if not entirely, due that excellent educational institution, the London School of Dental Surgery, which is constantly sending out young men qualified in every respect to practise

with credit to themselves and benefit to society, and of whose operations I can speak in words of high praise. So much for the past. On the present state of the Society, it is unnecessary for me to enter, seeing you have recently had an admirable account of it in the valedictory address of my excellent predecessor. As to the future, the year opens well. I have received promises of papers which I hope and believe will be of interest to you, and worthy of the high reputation the Society has gained in this respect; and I earnestly urge the members to give us, from time to time, records of all cases of interest which may come under their care, either in private or hospital practice, with the mode of treatment adopted, and the results, whether favourable or otherwise. Such records are peculiarly valuable: they often afford us new light and valuable aid; and as we are all of us every day acquiring fresh information in the treatment of disease, it is of the greatest advantage we should know how others deal with such cases. The members of the Society have always shown the greatest frankness in communicating anything they may think will be of service to each other. There is only one fear—that diffidence may sometimes prevent men rising to describe their treatment of particular cases. This may be carried too far: the Society will always be grateful for such matter, and will discuss it in a fair, generous, and candid spirit.

Before concluding these brief remarks there is one point I should wish to bring under your notice. I have for some time past been impressed with the conviction that if we could by any means persuade some of the older and more experienced members of the profession to give practical instances of their modes of operating, much benefit would result. This probably may be effected. I am sure the Committee of Management of the Dental Hospital would allow us the use of one of their operating-rooms, and any other appliances at their disposal. I venture to think this suggestion worthy of your consideration, and that it is scarcely possible to estimate the amount of good that would be accomplished by such practical exhibitions.

I will not trespass further on your patience; but, when the time comes for me to surrender back to your hands the trust you have been good enough to confide to me, when I have to

thank you for what I know I shall receive—your aid and support—may your verdict be that I have advanced the interests of the Society, or at least that I have honestly endeavoured to benefit the profession in whose welfare we are all so immediately concerned.

The following gentleman was elected a Member of the Society:—

Mr. WILLIAM STRINGFIELD, of Lowestoft, Suffolk.

The following gentlemen were proposed as Members of the Society:—

Mr. W. C. WILLIAMS.

Mr. JOHN FAIRBANK.

The CURATOR exhibited a remarkably good dried preparation of a pike's skull, presented by Mr. Petty to the Museum. It was very difficult to make these preparations without distorting the jaws, but it would be seen that the position of every part had been particularly well maintained in this specimen. The pike was a native of the Thames.

Mr. MUMMERY wished to make a few remarks upon the skull of an aged Hippopotamus, which he had much pleasure in presenting to the Society's Museum. In the upper jaw the second premolar on the left side, and all the three premolars on the right, had been lost, and the sockets obliterated, with the exception of one which was worn down to the neck. The true molars all exhibited signs of severe attrition, the dentinal pulp having usually undergone calcification. The crown of the right first true molar was so deeply worn down that its four roots had become separated from each other during the animal's life, and alveolar abscess had ensued. It was therefore evident that, as these animals advanced in years, although their incisors and canines were furnished with persistent formative pulps, and enabled them to procure their food, the masticating organs, destitute of any similar provision, suffered irreparable injury. It was a noticeable fact that the lower teeth had not sustained injury in nearly so great a degree; and he had often found a curious parallel in the skulls of the ruder human races, among whom the upper first molar usually suffers most from the attrition of their hard and tough diet.

Description of an Odontome. By CHARLES S. TOMES, Esq., Curator of the Museum.

LIKE the somewhat similar Tooth-tumour, which I described at the last meeting of the Society, this specimen has lain for several years in my father's collection in the Museum, but I am unable to discover any published description or figure of it.

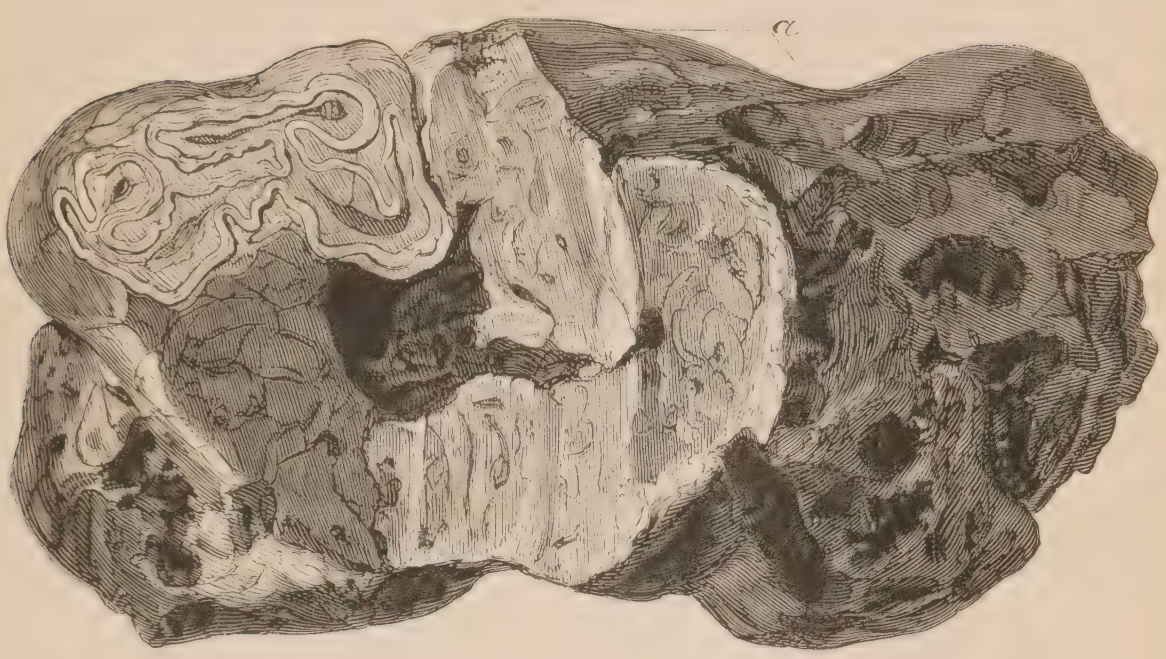
The tooth from which it springs is a right lower molar of a horse, which has been but little altered either in size or shape, although there is attached to it this enormous mass, five or six times as large as the tooth itself and weighing upwards of 10 oz.

The great bulk of the mass lies in front of the tooth, though a portion extends over the outside; hence the anterior and external surfaces of the tooth are covered up by the new growth, which is accurately adapted to them, though it is only attached by a comparatively small pedicle to the outer surface of the crown. This is well seen where the greater part of the mass has been broken away from that which is in the immediate neighbourhood of its pedicle. It is noteworthy that

the tooth proper is covered by its external layers of cementum in a perfectly normal manner, even where it was overlaid by the new growth being accurately moulded to its surface, indicating that the development of at least that portion of the tumour was subsequent to the completion of that region of the tooth.

Looking on the fractured surfaces, the mass is seen to consist of a dense shell, from which run stalactite-like processes, which more or less completely obliterate its central cavity.

The figure represents the upper surface, a part of which is deeply worn and grooved by the opposing teeth in mastication, a fact which would seem to indicate that the internal hollows were occupied by a living pulp; for, were it otherwise, it is difficult to suppose that it would have been sufficiently free from tenderness and pain to be useful in mastication: these hollows would have become occupied by various decomposing matters, which would have infallibly set up irritation in the surrounding tissues; moreover, the fact above mentioned, as to the tooth proper being covered with cement, shows that this mass was continuing to grow for some length of time, and moulding itself around pre-existing hard structures. In this way was produced the impression of the next tooth in front of it (at the point marked *a* in the figure), which was obviously much displaced by the advancing growth.



Looking down on the surface worn by mastication, we see (at the left-hand upper corner of the figure) the crown of the tooth, with the complex pattern characteristic of a horse's lower molar quite unaltered; this tooth, the internal and posterior surfaces of which are free, whilst the anterior and external surfaces are imbedded in the growth, formed a part of the masticating surface.

The remaining portion, which is gróoved and worn by mastication, presents a polished, smooth surface, with holes in places, and consists of one single histological structure—namely, cementum.

In the section made I did not discover any dentine or any enamel, and herein it differs from the Odontome described last month.

Nevertheless, although made up solely of cementum, the name exostosis is not altogether appropriate to it. In exostosis, successive layers

of cementum are added concentrically, layer after layer, on the surface of those already deposited; but we do not meet with huge independent outgrowths, springing away from the tooth, and wrapping themselves round, and modelling themselves upon, the hard structure with which they come in contact.

Moreover, microscopic examination of the mass shows that there is a structural difference between the external dense shell above mentioned, and the more internal parts of the mass. The outside consists of numerous parallel laminæ of cementum, not differing in any marked character from that which covers the fangs ordinarily in the herbivora. Inside this laminated covering there is a tissue quite devoid of anything like lamination, in which numerous bone-corpuscles are found, and an abundance of those globular forms which are seen in secondary dentine or in dentine of very imperfect formation. In places, those festooned outlines, considered as characteristic of absorption,* are traceable, the notches being occupied by large bone-corpuscles. In fact, there is, in one place, a minute fragment with sharply-defined edges, on the one side straight, and on the other deeply festooned, which lies imbedded in this central mass of osteoid tissue, and reminds me very strongly of the appearance

* Cf. figure in Tomes's "Dental Surgery," p. 78.

presented by the inner surface of the dentine shell of the Odontome described last month.* I should not, therefore, feel greatly surprised if sections taken in other places should reveal the existence of dentine in the mass, particularly as its structure corresponds very closely with that revealed by the section marked *d d* in the first-described specimen, where, it will be recollected, no dentine was seen.

The whole outgrowth springs from a smallish pedicle in the median groove which traverses the surface of a horse's tooth; from this point a soft mass seems to have grown, wrapped round three sides of the tooth, and extended forwards along the jaw.

This outgrowth may have originated from two sources: it may have sprung from the dentinal pulp, and so be of similar origin to that described last month; or it may have had nothing to do with the dentine and its pulp, and be referable both in its origin and its after-development to the cement. If this latter explanation be the true one (and it is one to which I should have very strongly inclined had it not been for the existence of that one minute fragment of tissue, too small to clearly identify, which looked so suspiciously like dentine), it is an argument in favour of the existence of a special "cement organ" in the

* Trans. Odon. Soc., Jan. 1872, p. 85.

herbivora. The existence of this special cement organ is strongly insisted on by Robin and Magitot,* and is adopted by Professor Broca, who explains, in this manner, the occurrence of all those tumours arising in connection with the teeth of herbivora with which he has met;† but the existence of a cement organ is altogether denied by Waldeyer.‡ If we adopt Professor Broca's classification of Odontomes, this specimen would probably be referable to his class of "Odontômes coronaires cémentaires," and could only have arisen in an animal having a special cement organ; for the sharp differentiation between its central, confused structure, and the regular well-defined laminæ of cement which surround it, entirely precludes the idea that it could have been wholly formed from the tooth-capsules, which these external laminæ probably were. But if, on the other hand, it be held to have arisen from the dentine pulp, the existence of such a tooth-tumour throws no light on this vexed question of the existence of a cement organ.

Whatever may be the cause, these outgrowths

---

* Ch. Robin et E. Magitot, Mémoire sur la Genèse et le Développement des Follicules Dentaires. Paris, 1860, p. 145, et seq.

† Broca, Traité des Tumeurs, p. 350.

‡ Stricker, Human and Comparative Histology, New Sydenham Society Translation, 1860, p. 490.

seem not to be so very uncommon in the teeth of horses, though I am unable to find any record of one attaining to the dimensions of this specimen. Other examples will be found figured in Broca's work (pp. 352, 353); in Forget, "Des Anomalies Dentaires, et de leur Influence sur la Production des Maladies des Os Maxillaires," and in Owen's "History of British Fossil Mammalia."

It is hardly necessary to discuss the appropriateness of the term "Hypertrophied Dilated Fang," for describing this specimen, for it is apparent to the naked eye that the fang is perfectly distinct from the tumour, which takes its origin much higher up, in fact, from the crown of the tooth; yet any nomenclature which would separate the present specimen widely from that described last month, would be manifestly imperfect; hence this specimen furnishes an additional argument, if one were needed, for rejecting the term "Hypertrophied Dilated Fang," as descriptive of this class of tumours.

The PRESIDENT then called upon Mr. Oakley Coles to read his paper.

On the Production of Articulate Sound (Speech).

By J. Oakley Coles, Esq.

Mr. President and Gentlemen,—

Some brief explanation is perhaps necessary as to the origin of the present paper. Four or five years ago, when paying special attention to the treatment of defects of the palate, I first found the difficulty of teaching those whom I had treated to speak correctly, or to put their organs in such a position that articulation should be possible. Much care with my pupils led to much vexation. I could find no book that gave such information as was necessary for such cases; and a mere reiteration of instructions was very confusing to the patients. Added to which, I was in doubt in many instances as to the way in which certain sounds were produced. Beyond this, no small difficulty seemed to exist as to the parts that were involved in the production of the elementary sounds.

After thinking the facts of the case carefully over, I determined on the following plan of ascer-

taining more accurately the physiology of speech. With this view, I took an impression of my upper jaw, extending to the posterior wall of the pharynx, and thereby including the soft palate and fauces; also an impression of the lower jaw, with the tongue in a state of repose. These I had engraved on one stone, with a drawing of the lips below (as shown in plate I.) A number of these I had printed. Then my trial began. The mode I adopted at this stage was to make a mixture of gum and flour, and paint over the whole of the hard and soft palate and the surfaces of the teeth of my upper jaw. I then sharply articulated a letter. On the upper jaw, where the tongue had come into contact, the flour was removed, and deposited on that part of the tongue which had touched it. These localities were at once faithfully transcribed on to the engraved plate with red paint.

This I believed to be a great step in advance, and reduced the physiology of this subject to more defined limits. One point of the utmost practical importance to be determined was as to when there was complete separation of the nares from the mouth by means of the soft palate.

This I decided by means of a very delicate test, shown to me by Professor Czermak, of Leipzig, some two years since, when on a visit to this country.

By placing a highly-polished table-knife under

the nostrils during the articulation of any sound, the escape of air through the posterior nares is made at once perceptible by the deposition of moisture on the cold steel. This mode of observation is most valuable, not only for this purpose, but also for ascertaining how far an artificial palate completely separates the mouth from the nose. It may also be used with advantage after the surgical operation for cleft palate.

Having explained the origin of this work, and the way in which I have carried it out, I will pass to the consideration of the subject itself.

To begin with, we must clearly recognize the difference between voice and speech. It may be stated, broadly, that voice is produced in the larynx, but speech is produced in the mouth.

A few words may not be out of place on the production of voice as a necessary antecedent to articulate sound or speech.

The special organ of voice consists of the larynx. The trachea, lungs, and upper part of the pharynx may, however, be regarded as accessories to it: the lungs, as the active agents in propelling, by their contraction, the air through the larynx; the trachea, by its increased or decreased length, affecting the tone of the voice; and the upper part of the pharynx, as aiding in the same purpose.

The larynx is an elastic box, consisting of the thyroid, cricoid, and arytenoid cartilages. These

are bound together by a system of muscles and ligaments, admitting of a large degree of movement, and yet of singular elasticity.

Situated about one-third from the highest level of this chamber—and inserted into the thyroid cartilage at one point, but passing backwards, and by their separation forming two sides of a triangle—we have the vocal cords, attached at their extremities to the arytenoid cartilages. By the movement of these cartilages the margins of the vocal cords may be approximated so as to come into actual contact. The arrangement of the cartilages is such that these cords are capable of variable tension as well as approximation; and it is by the vibration of these cords, produced by the rapid passage of air from the lungs through the trachea, that voice is produced.

The differences in the sound of the voice are the result of the difference in tension of the cords, and their relative position to each other, aided by the difference in the length of the trachea, and the configuration of the upper part of the pharynx, and the position of the epiglottis and soft palate. Sound having passed from the larynx into the region immediately above, may then be modified or articulated, and produce speech. It is this which is of especial interest to us as dental surgeons, since it is here that our domain of labour and observation in practice begins.

Speech is due to the manner in which the

column of air is arrested, condensed, or thrown into vibrations by the organs of speech, which consist of the tongue, hard and soft palate, teeth, and lips; the cheeks also may be said to take a part in the production of speech, though they cannot be regarded as organs of speech proper. The pharynx and nares may be put into the same class as the cheeks.

An examination of the plates, which need not be more fully described, will show how frequently the nares are separated from the mouth by the action of the soft palate and the constrictors of the pharynx. This is a point of great practical importance and value, especially when we notice how frequently defects arising from this action are brought under our notice.

What is the practical use of the present paper?

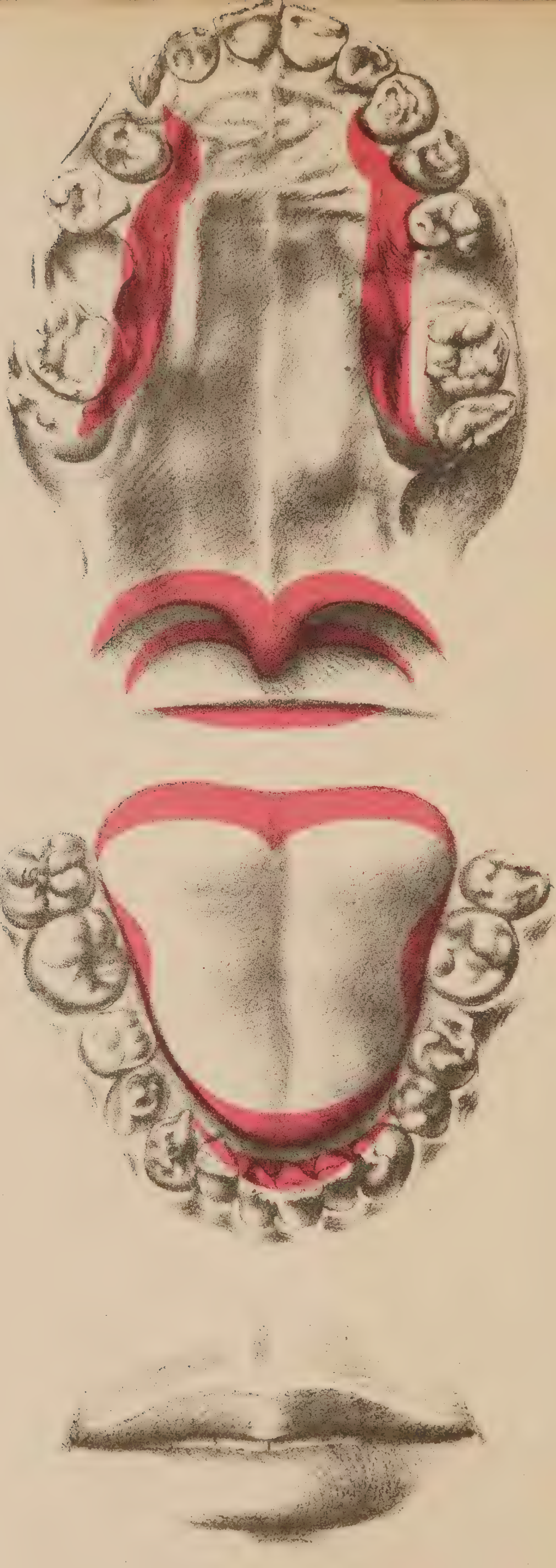
In the first place, to show, in a more satisfactory manner than has been hitherto done, the relative position of the parts concerned in the production of speech, and thus render the physiology of the subject more precise in its nature. In the second place, to enable those who have been treated, by operation or mechanical appliance, for cleft palate, to acquire a more accurate knowledge of the different sounds in the English alphabet, and thus learn the means by which they may be combined to form words and sentences. In the third place, to enable the practitioner to determine on what is the cause of any defect in

Plate 1

A Vowel. Lingua-Dental

Plate 2

B   Consonant   Lingua-Palato-Labial.   Explosive.   Flat.



C Consonant. Lingua-Dental.

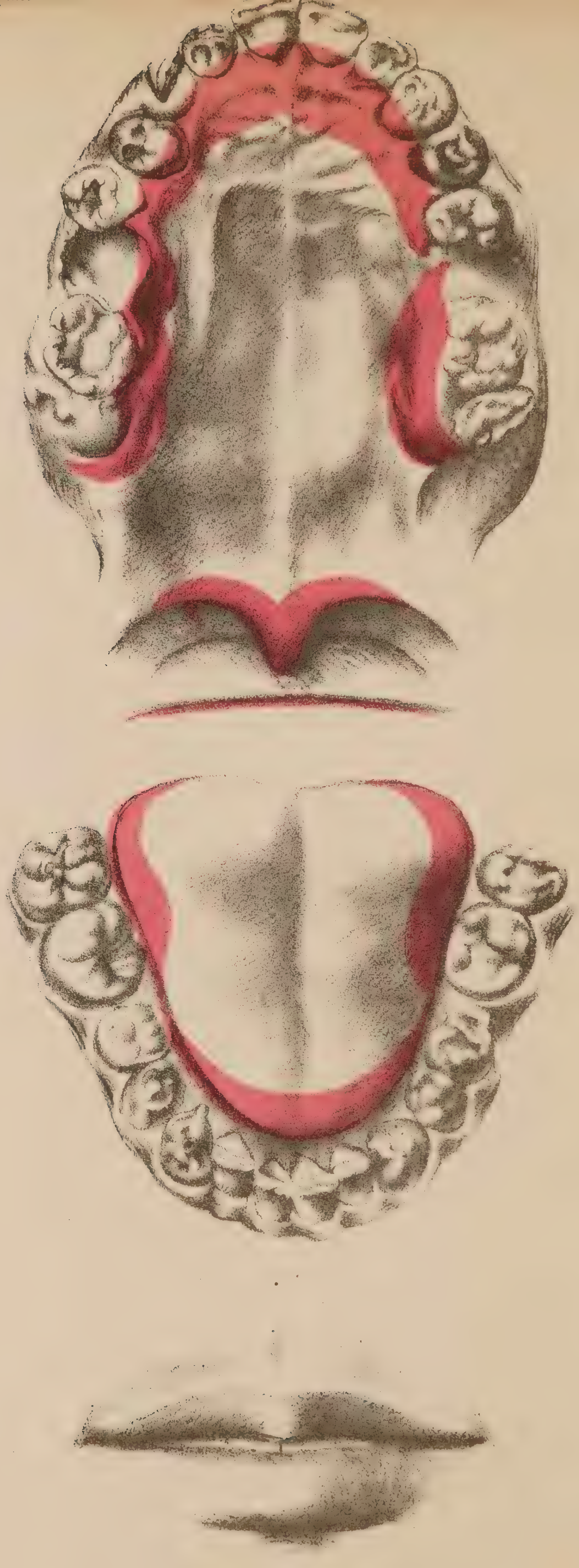


Plate 4

D Consonant. Lingua-Dental. Flat

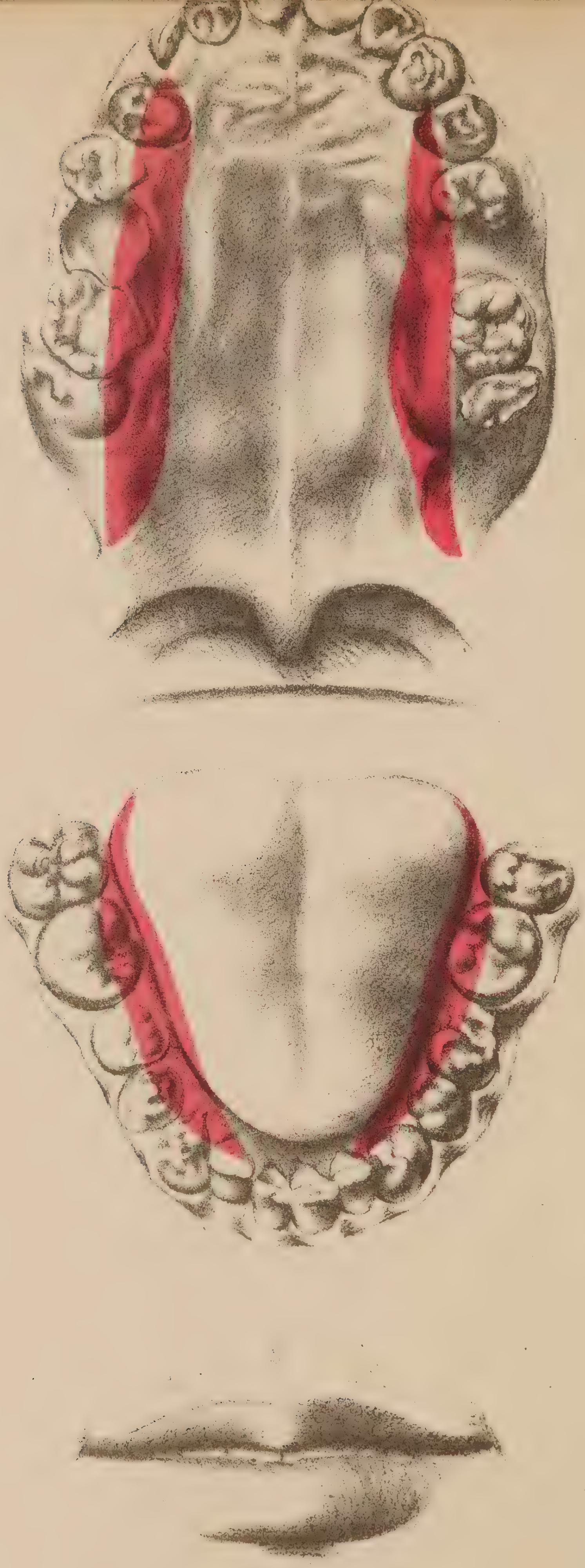


Plate 5

E Vowel Lingua-Dental

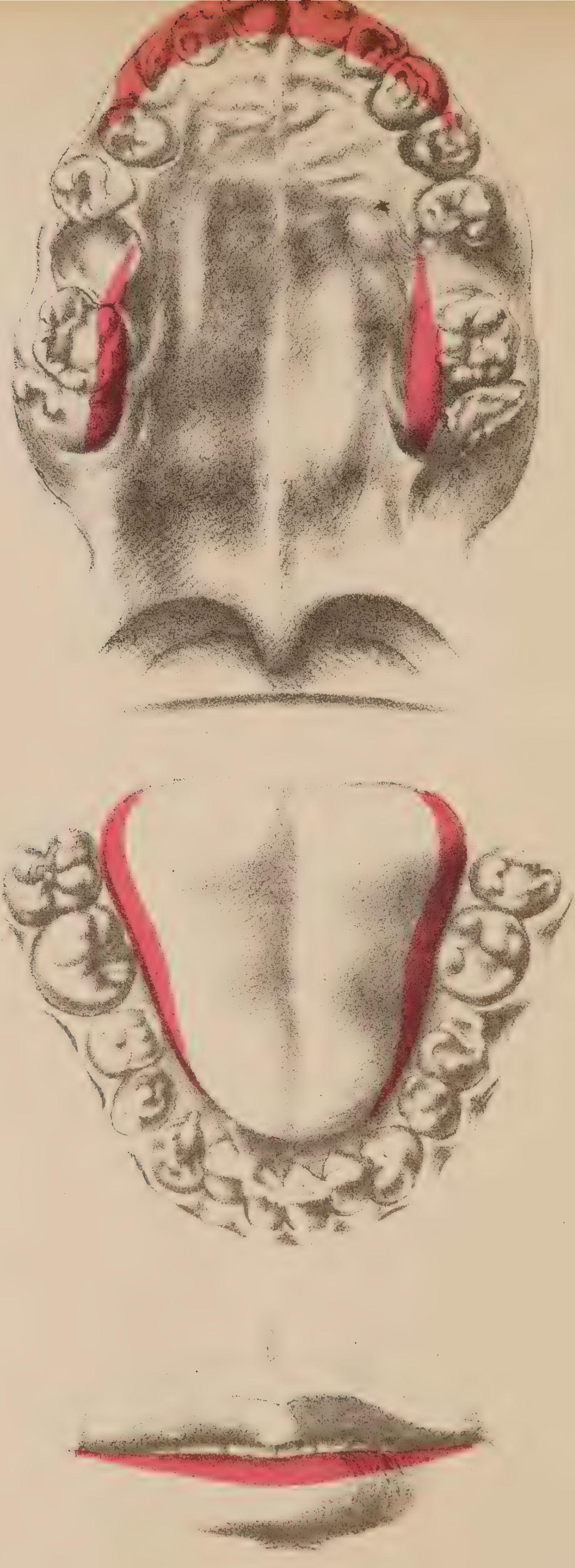


Plate 6

F Consonant. Labio-Dental. Sharp

utterance of a patient brought to him, by being able more accurately to fix upon the locality which is imperfect in action. And lastly, and by far the most important, and to my own mind, interesting use of all—to help on the work of teaching to speak those who are unfortunately deaf mutes.

NOTES AND EXPLANATIONS OF THE PLATES.

Those portions of the plates which are coloured red show the points of the mouth which come into contact when the letter printed at the foot of the engraving is pronounced.

It would produce too much complication to indicate the sequence of the several movements involved in the production of each sound : this I leave to the teacher and the help given by the associate nervous action which will be found to accompany the effort of the patient to articulate plainly. While it will be seen that I have adopted some new combinations of terms in classifying the letters, I have avoided tabulating this classification lest I might be straying beyond the subject proper of the present paper. The names given to the different letters may, therefore, be taken as epitomizing the parts involved in their production.

Plate 1.—A Vowel. Lingua-Dental

Plate 2.—B Consonant. Lingua-Palato-Labial. Explosive. Flat.

Nares partially closed by Soft Palate and Pharynx.

Plate 3.—C Consonant. Lingua-Dental.

Plate 4.—D Consonant. Lingua-Dental. Flat.

Nares partially closed by Soft Palate and Pharynx.

Plate 5.—E Vowel. Lingua-Dental.

Plate 6.—F Consonant. Labio-Dental. Sharp.

Plate 7.—G Consonant. Lingua-Palato-Dental. Flat.
Nares completely separated from Mouth by Soft Palate and Pharynx.

Plate 8.—H Consonant. Lingua-Dental. Aspirate.

Plate 9.—I Vowel. Lingua-Dental.

Plate 10.—J Consonant. Lingua-Palato-Dental.

Plate 11.—K Consonant. Lingua-Palato-Dental.
Nares completely closed by Soft Palate and Pharynx.

Plate 12.—L Consonant. Lingua-Palatal. Slightly Nasal.

Plate 13.—M Consonant. Labio-Nasal. Partially Lingua-Palatal.

Plate 14.—N Consonant. Lingua-Palato-Nasal.

Plate 15.—O Vowel. Labial.

Plate 16.—P Consonant. Lingua-Palato-Labial. Explosive. Sharp.
Nares partially shut off by Soft Palate and Pharynx.

Plate 17.—Q Consonant. Lingua-Palatal.

Plate 18.—R Consonant. Lingua-Palatal.

Plate 19.—S Consonant. Lingua-Dental. Sharp.
Nares completely shut off from Mouth by Soft Palate and Pharynx.

Plate 20.—T Consonant. Lingua-Palato-Dental. Sharp.
Nares partially shut off from Mouth by Soft Palate and Pharynx.

Plate 21.—U Vowel. Lingua-Dental-Labial.

Plate 22.—V Consonant. Lingua-Dental-Labial. Flat.

Plate 23.—X Consonant. Lingua-Dental.

Plate 24.—Y Consonant. Lingua-Dental-Labial.

Plate 25.—Z Consonant. Lingua-Dental. Flat.
Nares partially shut off from Mouth by Soft Palate and Pharynx.

Plate 26.—CH Lingua-Palatal and Naso-Pharyngeal.

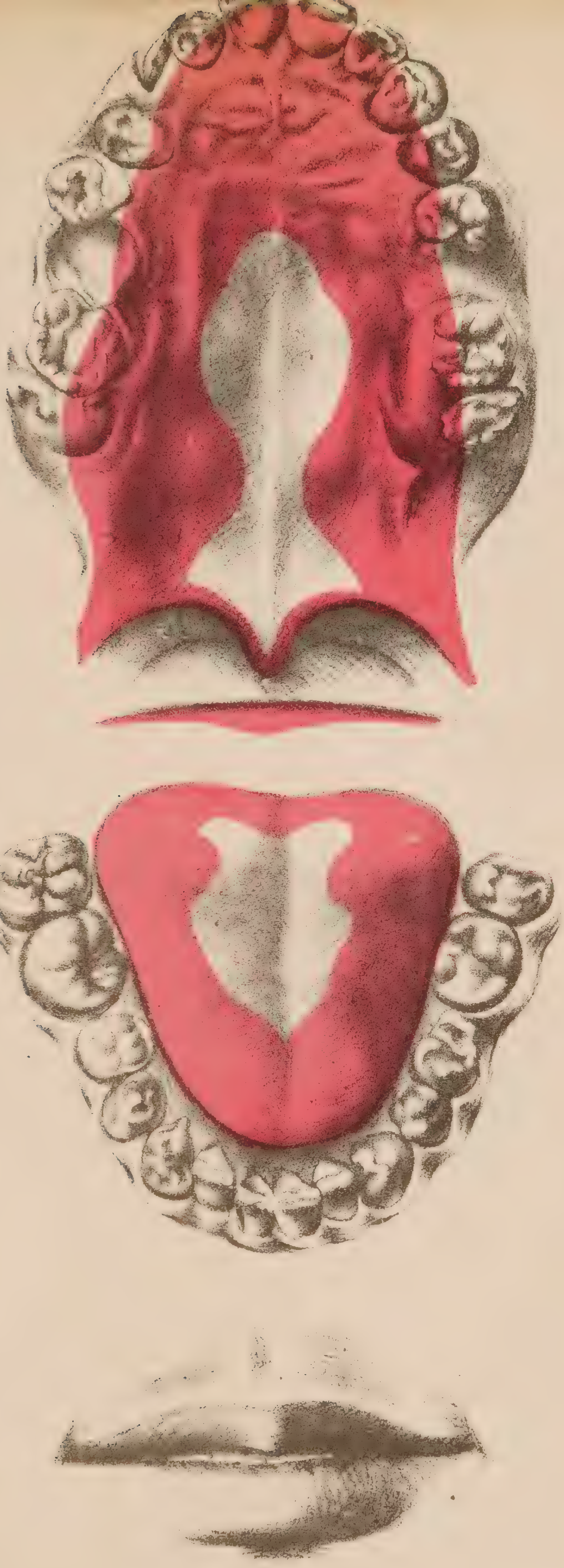


Plate 7.

G Consonant Lingua-Palato-Dental. Flat

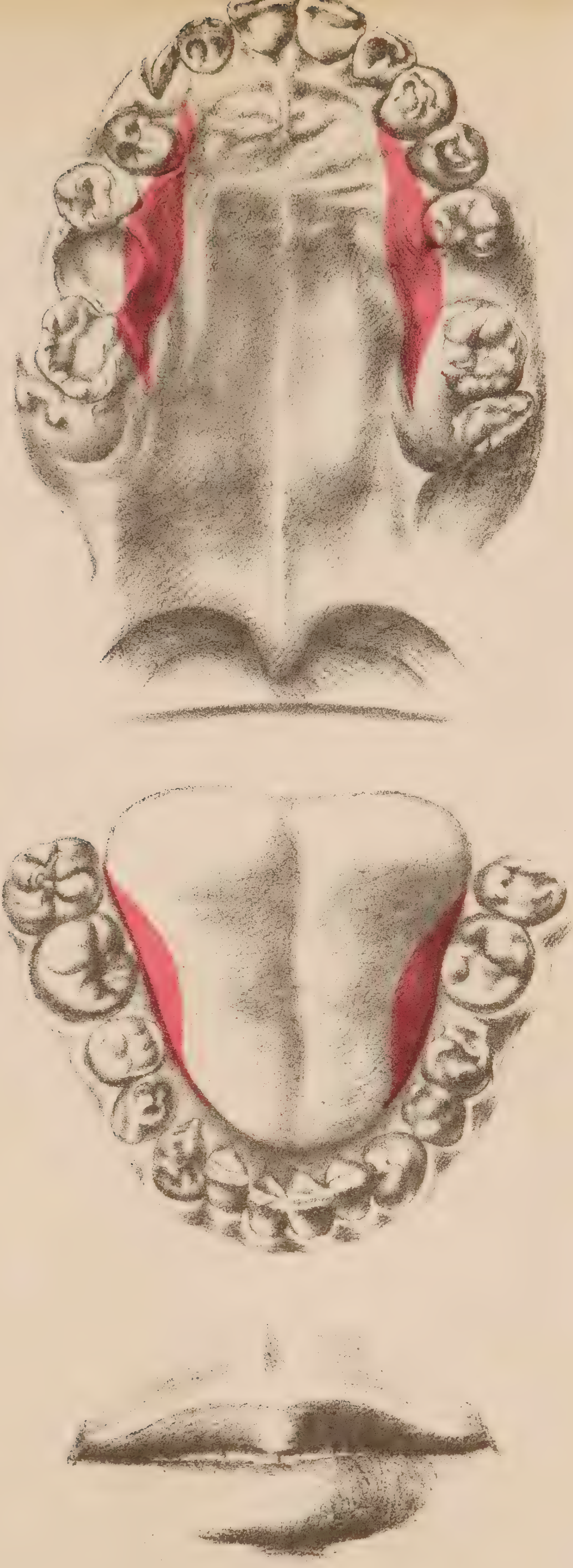


Plate 8.

H Consonant. Lingua-Dental. Aspirate.

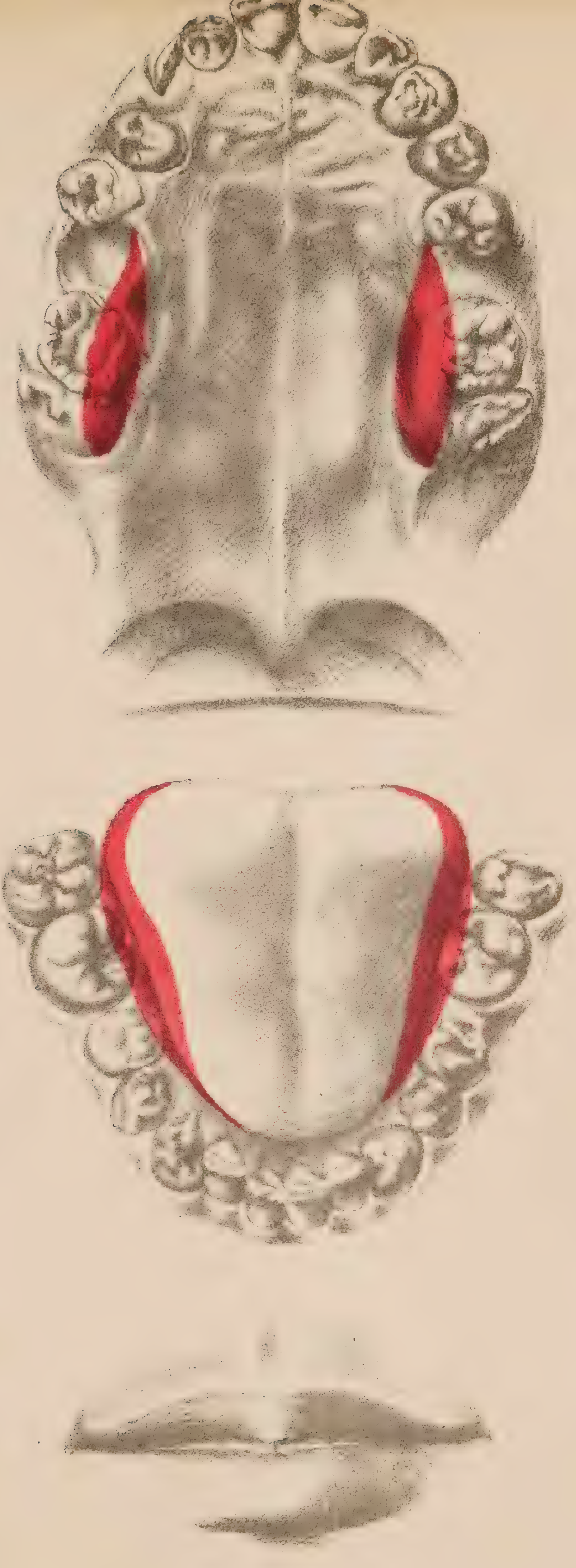
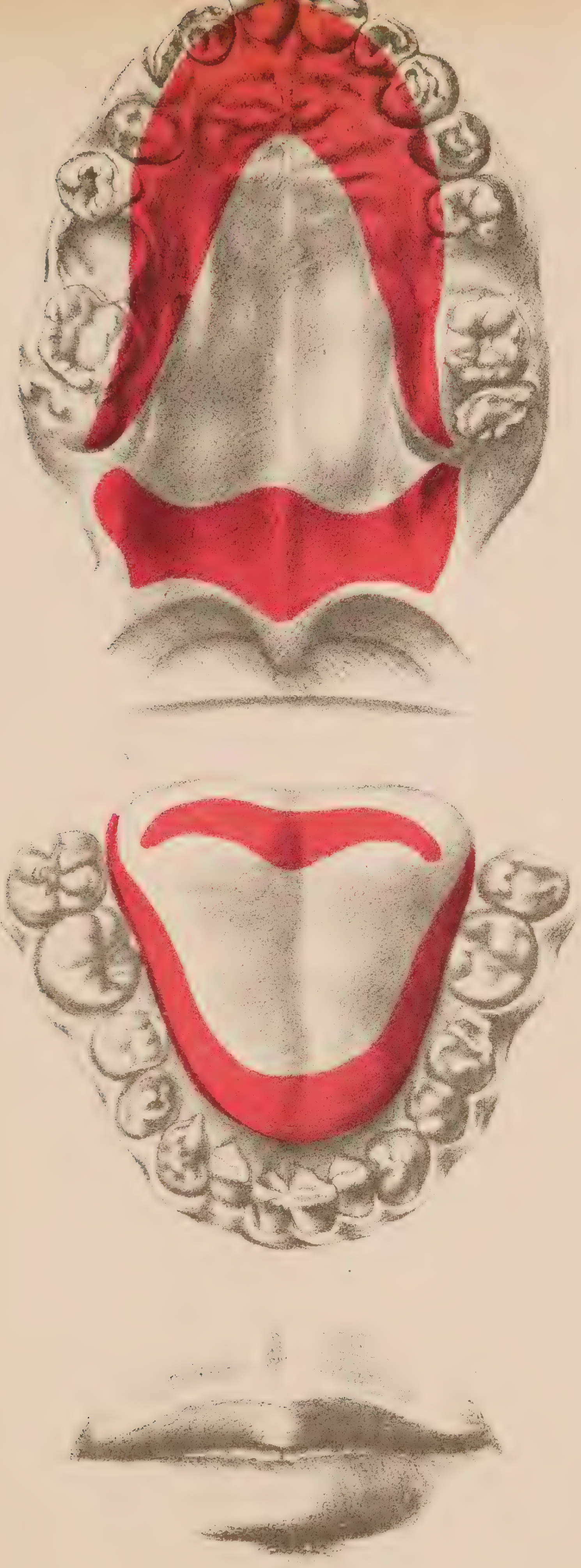


Plate 9

Vowel. Lingua-Dental.

Plate 10



J Consonant: Lingua-Palato-Dental.

Plate 11

K Consonant. Lingua-Palato-Dental

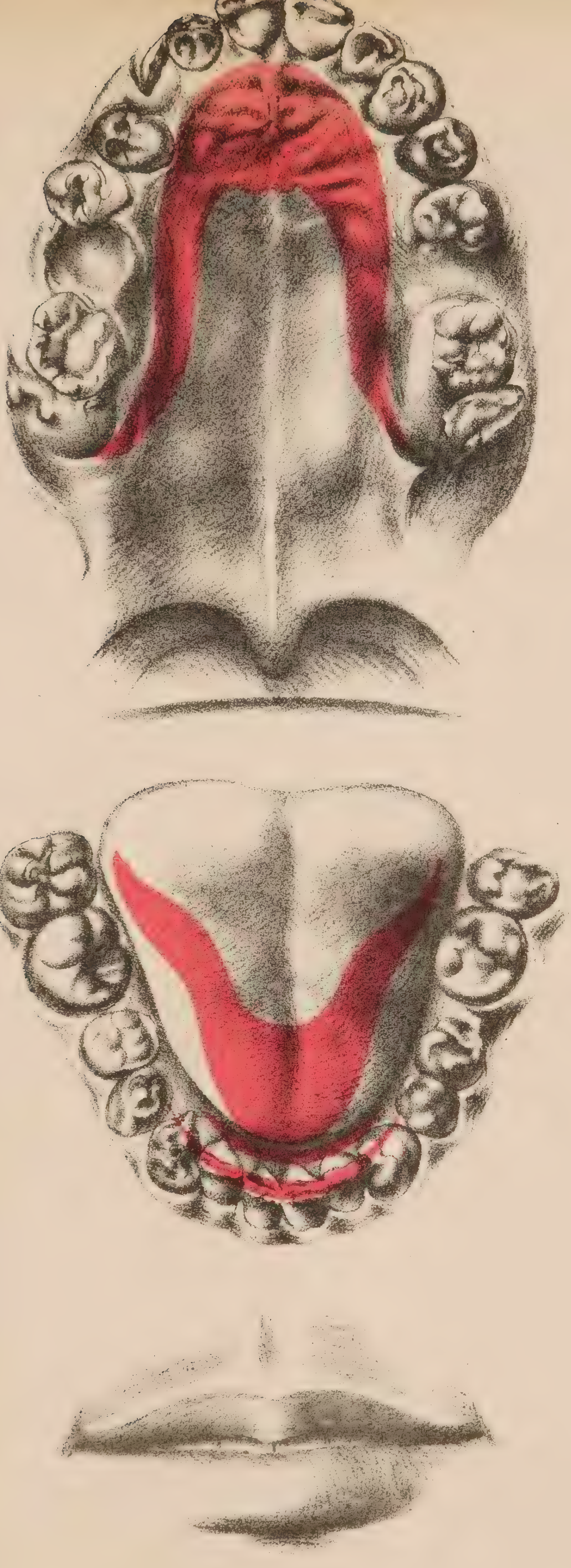


Plate 12.

L Consonant. Lingua-Palatal. Slightly Nasal.

Plate 1[illegible]

M Consonant. Labio-Nasal Partially Lingua-Palatal.

ate 14.

N Consonant Lingua-Palato-Nasal

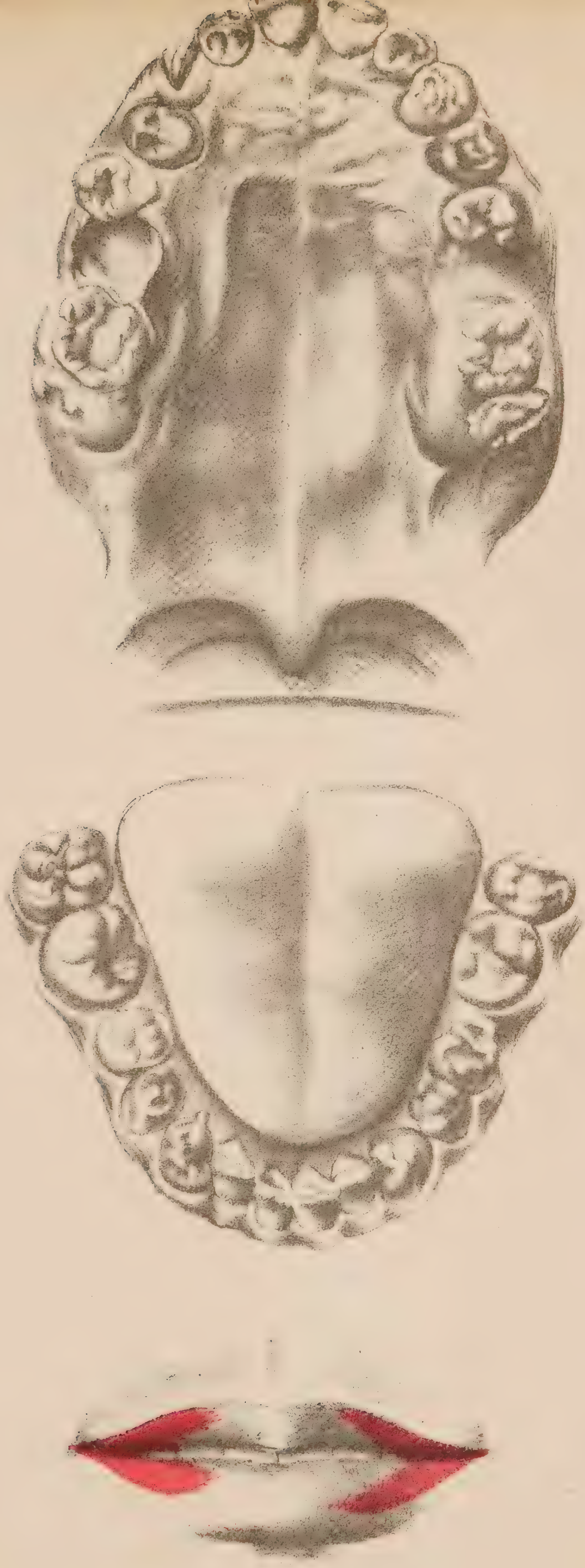


Plate 15.

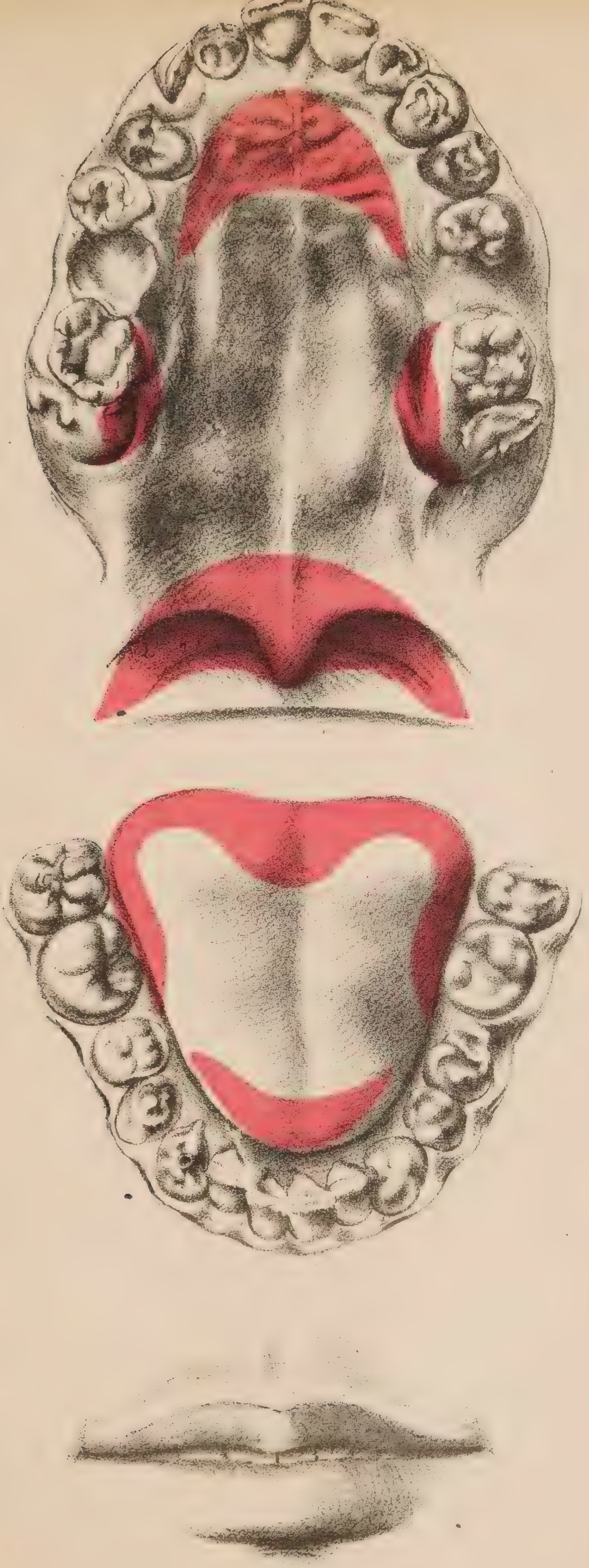
O Vowel. Labial.

Plate 16

P Consonant Lingua-Palato-Labial Explosive. Sharp.

17

Q Consonant. Lingua Palatal.

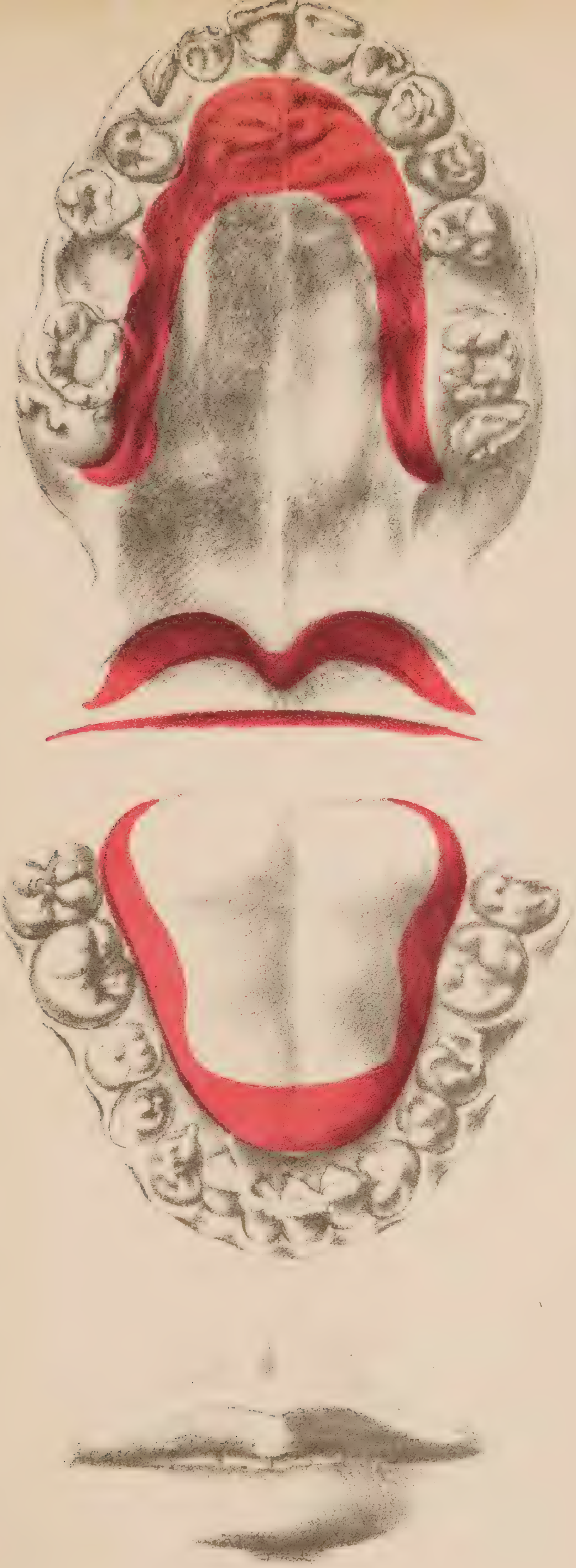


R Consonant. Lingua-Palatal

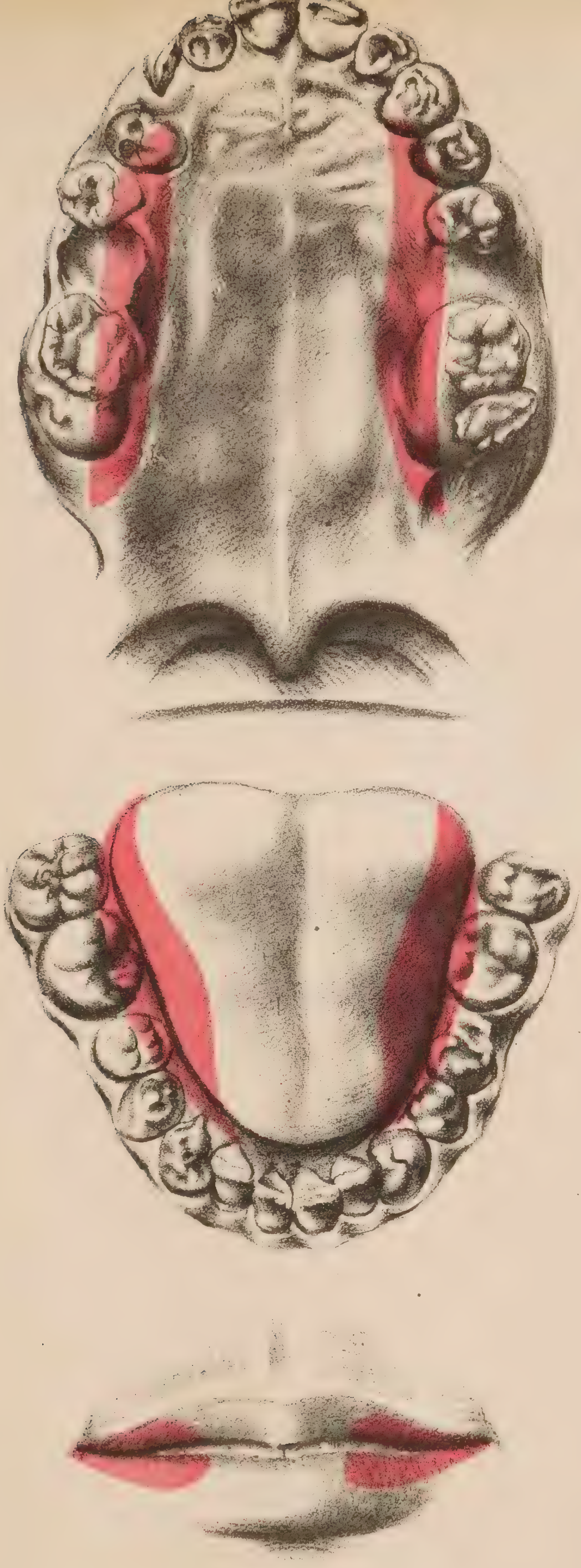
Plate 19

S Consonant Lingua Dental Sharp

te 20

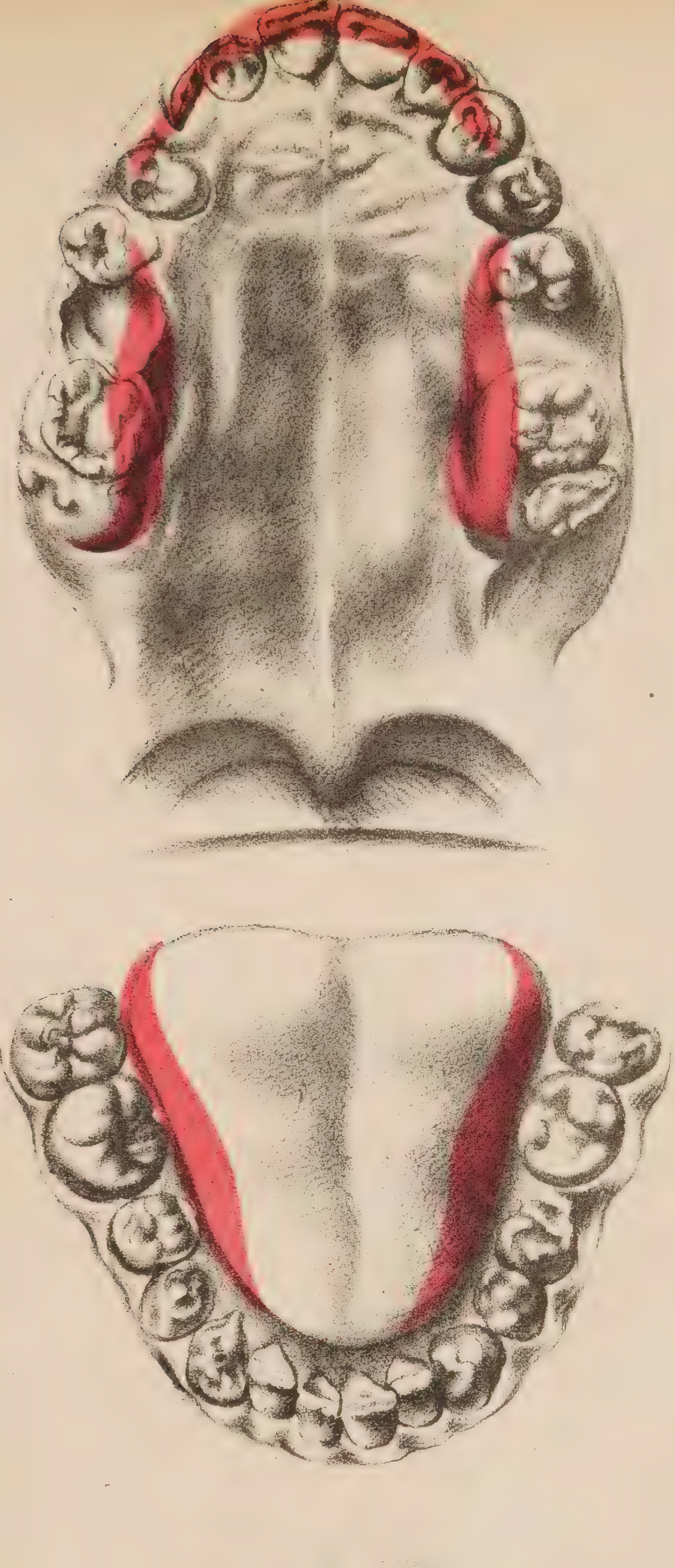


T Consonant Lingua-Palato-Dental Sharp



late 21

U



V Consonant Lingua-Dental-Labial Flat

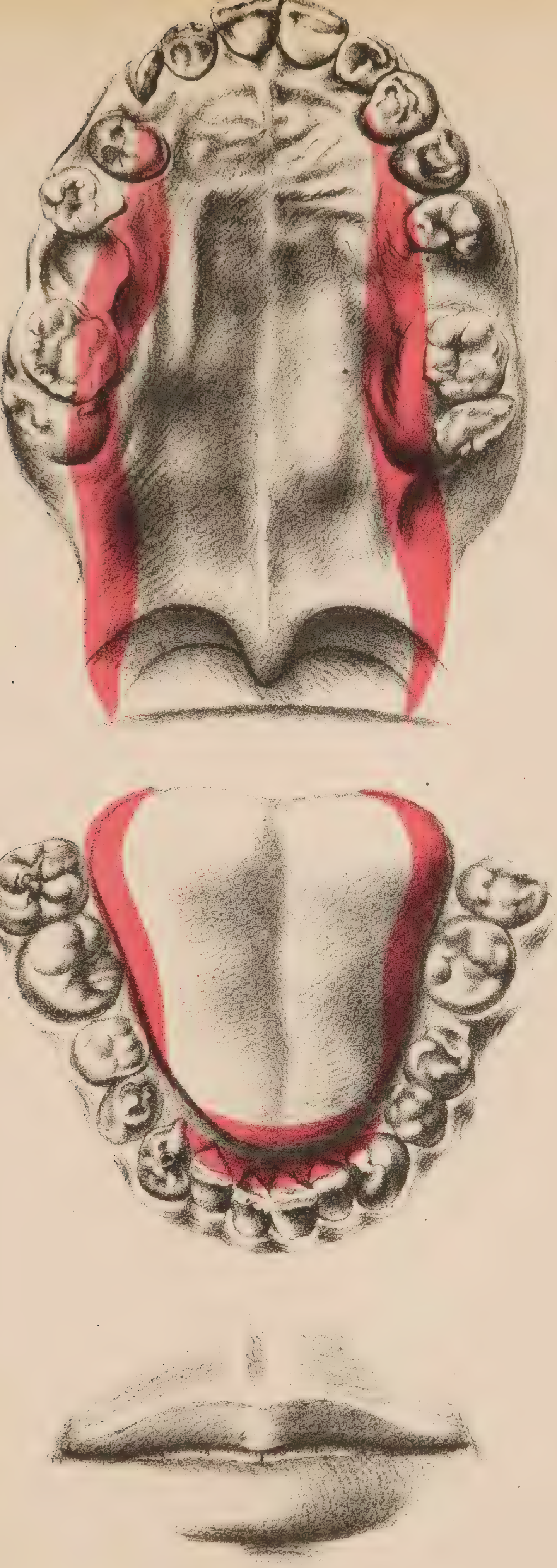
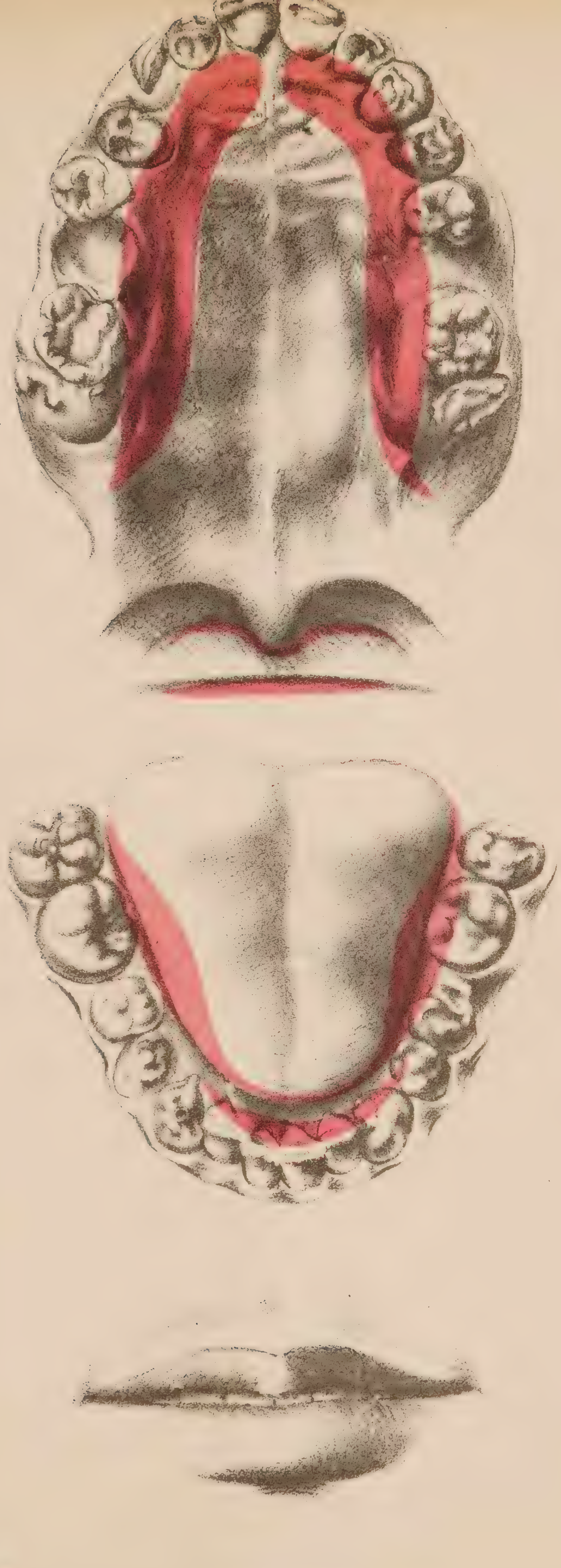


Plate [illegible]3

X Consonant Lingua-Dental



Z Consonant Lingua-Dental Flat

Plate 26

CH Lingua-Palatal and Naso-Pharyngeal

Discussion.

The President trusted that gentlemen would express their opinions so as to enable Mr. Coles to go on in the work he had so well commenced.

Mr. Sercombe thought the Society was under considerable obligation to Mr. Coles for bringing forward this subject. The method adopted by Mr. Coles for demonstrating the various parts engaged in producing speech was perfectly original to his mind. No doubt the investigation was in an elementary stage, and with further experiments there might be some modifications in the principles laid down as to the causes of articulate sounds. It must be recollected that different men moved their lips and tongues in a different manner to produce the same sounds, and therefore until he heard that it had been tried over a greater number of cases, he must decline to express any decided opinion on its merits. It was, however, a most instructive and important subject and one well worthy of the attention of every member. It was one, too, he thought, which had a special interest to those who were in the habit of treating congenital cleft palates. It was astonishing to find how ignorant people so afflicted were of the mechanical movements necessary to produce articulate sounds. There were some who were so ignorant of the movements of the tongue and lips necessary to coin articulated sounds, that there was scarcely any difference in their "no" and "yes" and other necessary words, and if such persons could be shown how to make these sounds, a great deal would be accomplished.

Mr. Charles S. Tomes must echo the remark of Mr. Sercombe, that different people produce the same sounds by somewhat different movements, some of which movements were therefore non-essential, and the diagram produced by different individuals would vary. Looking at the diagrams, it appeared to him that in the case of the vowel sounds, some non-essential

movements of the tongue had taken place. If you ask an accomplished Italian singer to go through the vowels, and placed a candle in such a position as to clearly see the interior of his mouth, you would find that the tongue would never touch the upper teeth, that it would lie in the bottom of the mouth and never rise to the teeth, whether the vowels be spoken or sung. Now, what these Italians say of the English, is that we never do speak clearly, that we do not articulate our words properly, but confuse the sounds by all sorts of unnecessary and even harmful movements, and the very first thing a singing-master sets his pupil to do, is to stand in front of a looking-glass and, candle in hand, learn to say his vowels purely and without unnecessary movement of the tongue or lips. Now, if the vowels can all be spoken most clearly with the tongue flat on the bottom of the mouth, it is quite certain that the contact with the upper teeth is not essential, and being not essential, is objectionable in a diagram used for teaching. The only vowel, in the case of which Mr. Coles's diagram appears quite correct, is the vowel "o"; in all the others the upper teeth are marked, and the way in which the teeth get thus accidentally touched is, I think, this,—we seldom say a vowel sound without its changing towards the end into something else, some other vowel; for instance, it is very difficult to say "a" without making a sound like "ae"; but though I cannot but think the diagrams admit of amendment in respect of the vowels, I quite agree with Mr. Sercombe that we are under a great obligation to Mr. Coles for the ingenious method he has adopted for advancing our knowledge of this subject.

Mr. Coleman thought considerable difference existed between the art of articulating during singing and in speaking. Persons suffering from congenital cleft palate could often render words fairly distinct during singing. This was still more evident in the case of extreme stammerers, who never experienced the want of muscular control over the organs of speech during singing. It was a common plan some few years ago with inveterate stammerers to make them sing sentences, and from so doing to gradually drawl them out: it cured the

stammering, but left them with a very monotonous kind of voice. Then again, in evidence of the fact that articulate sounds could be produced in more ways than one, were the cases where the whole of the tongue had been removed. He remembered one such case in particular, where the small amount of defect in the voice was quite remarkable. He felt they were much indebted to Mr. Coles for his paper. The original experiments he had carried out were very valuable, and if further prosecuted would lead, no doubt, to important results. He might mention that he had treated a few cases mechanically for defective speech : he had, where a lofty and contracted palate existed, inserted a vulcanite plate, and the result had been satisfactory ; but what in such cases had proved a point of interest, was that after a time the patients spoke as well without the appliance as with it,—it had probably only served the purpose of Demosthenes' pebble. When the teeth were lost, the lips, to a great extent, supplied their place in the production of articulate sounds, and the closure of the cheeks at the back of the mouth under these circumstances, no doubt, accounted for their being so bitten on when the teeth at the back of the mouth were artificially supplied.

Mr. Dennant considered, from the small number of persons who were able to talk on their fingers, that mutes were almost shut out from society, and thought that any plan which could be devised for teaching them to articulate must be hailed with great delight and satisfaction. He agreed with the previous speakers that Mr. Coles was entitled to great praise for attempting by this scheme to solve such a difficult problem. He would ask whether Mr. Coles considered his plan, if generally carried out, could be applied, in the case of congenital cleft palate, where the artificial substitute is provided? With reference to what had been said about the Italian pronunciation of the vowels in singing, it should be borne in mind that the Italians made the "a" "ah"; "e" "a"; and the "i" "e," so that if this were adopted considerable modification would be made in the position of the tongue.

Mr. Mummery regarded Mr. Coles's paper as a valuable and suggestive contribution to a very important subject, as he had

usually found, in cases of indistinct utterance, from whatever cause, that there existed great difficulty in teaching the patient what organs it was necessary to use for the production of particular sounds. He had been somewhat surprised on undertaking the case of an intelligent young lady with congenital cleft palate of a very extensive character, to find that she was not aware (save on the testimony of her friends) that she spoke differently from those around her. He consequently experienced considerable difficulty at first in teaching the patient thoroughly to appreciate the difference between distinct and imperfect articulation; but after an artificial palate and velum had been adapted, she had given diligent attention to the practice of suitable exercises, and was now making most satisfactory progress. Mr. Mummery would refer to another and a very curious case,—that of a vigorous young man, aged 22, who, although possessing a well-formed palate, still continued to employ the imperfect articulation of a child of three years old. Being a somewhat self-willed boy, he so resented the criticism of his friends that he grew up to manhood with his speech so imperfect that he had often been obliged, in the course of his business, to employ the services of one of his workmen as interpreter. The palate, although widely arched and well-formed, was somewhat highly vaulted, and he had acquired a habit of placing the tongue against the roof. The entire space was therefore filled up with a vulcanite plate, which was brought down to the necks of all the teeth; and the tongue being thus of a necessity brought forward, he was now learning to employ the teeth and lips in a natural manner, with a very encouraging success.

The President.—How long did your patient wear the instrument?

Mr. Mummery.—About a year. He can now articulate perfectly.

Mr. Sercombe had had a very similar case under his notice. A French professor, with a most correct acquaintance of our language, came to him one day in a state of excitement at having been discovered to be a foreigner. He was riding in an

omnibus, and upon calling to the conductor to let him out, some one in the buss told him he was a foreigner. Though he had been in England forty years, and had lived among English people, and had a most critical knowledge of our language, yet he had in early days become so impregnated with the French accent that he did not and could not know that he was not speaking English with the finest London accent. With reference to people with cleft palates, he was certain they did not know that they spoke differently to other people, and it was most important that parents and teachers should be warned against allowing their children to acquire an imperfect articulation. He had in his mind the case of a barrister with a congenital cleft palate who practised as a chamber barrister, whose articulation was most indistinct, and who yet would not consent to wear an apparatus, because of the temporary inconvenience it was to him, as, in his opinion, his articulation was not so indistinct as to make it worth his while to endure the inconvenience for a few days.

Mr. Charles S. Tomes explained that in speaking of the vowel "a" he had in his mind the Italian letter "e," so that Mr. Dennant's objection would not hold good. Moreover, vowel sounds were pretty nearly the same in all languages, so far as our present purpose was concerned, that is to say, that the upper teeth need not be touched in the pronunciation of any vowel sound in any language whatever. He could not agree with Mr. Coleman that there was any sharply-defined difference between speaking and singing : one cannot speak a single word without speaking on some particular note, and the difference between singing and speaking was one of degree, not of kind, that is to say, the difference is produced by the preponderance, in the one, of vocalization over articulation, in the other of articulation over vocalization, but both vocalization and articulation were essential alike to speech and song, and the remarks he had previously made about the articulation of vowels would applly equally to speaking and singing.

Mr. Coleman thought this distinction must be drawn between singing and speaking, viz., that the one must be done

with the mouth open and the other with the mouth at times nearly closed. Of course all sounds in ordinary speaking were a combination of musical notes, produced by the vocal cords; but, it must be recollected, that the speech was very much modulated by the action of the tongue, the closure of the lips, and the formation of the mouth. It was perfectly clear that all falsetto notes must be made with the mouth open and the lips unclosed during the whole of the word, that is to say, in the manner of a ventriloquist. It must also be recollected that in music it was desired not to give a distinct so much as a harmonized sound.

The PRESIDENT then called upon Mr. Oakley Coles to reply.

Mr. OAKLEY COLES, in replying to the discussion, said: In preparing the alphabet in the present form, I have endeavoured, as far as possible, to confirm the results of my own researches by reference to the works of those who have already worked at the same matter. It is clear that the present paper must be regarded rather as the demonstration of a new mode of observation than a complete result of work done. With reference to the fact that different people will pronounce the same letter in a different manner, I suppose we may put it in the same position as that, although everybody walks by the movement of the legs, no two people walk precisely alike; and I believe that practically this indicates the amount of difference that usually occurs. Still it is most desirable that the present system should have the most careful investigation; but, as it is capable of almost illimitable development, so it must necessarily be uniformly progressive. I have transcribed the vowel sounds as I found them usually produced. I have taken no outside standard with regard to them, but have deemed it wiser, in a work intended for those who desire to speak the language of every-day life, to adopt the conventional mode of articulation. Physiologically, this may be wrong; practically, however, I believe results will bear me out. There is undoubtedly some difference in the mode of articulation during singing from that of simple speech, and it is further proved that speech may be produced in a perfectly novel way, as in

those instances where the tongue has been removed by a surgical operation; we know, also, the curious results of putting in artificial palates for defective utterance or imperfect organization. All this tends to show how much more speech in its purity depends on function rather than organism. The present mode of teaching will, however, be found of great service to those who have been treated for such deformities as congenital cleft palate, either mechanically or by operation at the hands of the surgeon. There is one special class of cases that I have had frequently under my care,—where there has been defective utterance from want of sufficient nervous power in the tongue. In these instances, some instrument that will set up counter-irritation is generally the best mode of treatment, some slight instruction being then quite sufficient to induce the normal action of that organ. As a rule, the cause of this defect may be traced to some check received early in life, and is usually accompanied by a highly nervous temperament. In conclusion I have to thank you, Mr. President and Gentlemen, for your kind reception and discussion of my paper.

The PRESIDENT considered the paper entered into, to them, a comparatively novel subject, and it had evoked a most interesting discussion. Mr. Coles had treated the subject most ably, and he was sure he but interpreted the sense of the meeting when he awarded that gentleman their best thanks. He felt sure also they would join with him in thanking Mr. Petty and Mr. Mummery for their presentations to the Museum. His only duty now was to adjourn the meeting until Monday, March 4th, when a paper would be read by Mr. Charles S. Tomes, entitled "The Chemical and Physical Properties of Amalgams."

GENERAL MONTHLY MEETING,

Monday, March 4, 1872.

THOMAS UNDERWOOD, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentleman was duly elected a Member of the Society :—

Dr. Bogue, New York.

The following gentlemen were proposed for Membership of the Society :—

Mr. S. Hamilton Cartwright, M.R.C.S., L.D.S., 32, Old Burlington Street.

Mr. J. O. Edwards, Batavia, Java.

Mr. Charles J. Fox had much pleasure in presenting for exhibition a specimen of a tooth kindly sent up for that purpose by Mr. Rodway, of Torquay. According to that gentleman's statement, the tooth had been taken out behind the centrals, and it was believed to be the two laterals united.

The President.—Was Mr. Rodway present?

Mr. Rodway, jun.—My father said it was placed upon the palate behind the two central incisors and that the two canines were present in their normal position, but that the laterals were absent. From that latter fact he inferred that the laterals had united.

The President thought it was a very interesting specimen, but he could hardly think that it represented the union of two laterals.

Mr. Coleman observed that it was the usual custom of other Societies, and occasionally the habit of their own, to hand over certain specimens to a Committee for the purpose of investigation. The specimen brought before them by Mr. Rodway, through the medium of Mr. Charles J. Fox, certainly deserved more attention than that which the Society had seemed disposed to give it that evening. From what he had gathered from Mr. Fox's statement, made while he was carrying round the ballot-box, he understood that the specimen was supposed to be the united laterals, situated behind the two central incisors of the upper jaw. Now, he thought a case of this kind might perhaps throw some little light upon the question of the early development of teeth. It was not difficult to conceive the gemination of contiguous teeth, upon the views of development as advanced by Goodsir, or the more modern ones which had superseded his; but there appeared a greater difficulty to his mind in accounting for the union of teeth usually developed at some distance from each other. If asked his opinion upon the subject, he should say that the specimen represented the union of a lateral and a supernumerary tooth rather than two laterals; but whichever it might be, he did think it was worthy of the investigation by a Committee, which it was in the power of the meeting to appoint.

The President.—Was it not a question for the Council?

Mr. Coleman thought not. The meeting had full power to do as he suggested, and he would propose that Mr. Tomes, Mr. T. Rogers, and Mr. Cartwright be requested to act in that capacity.

Mr. Dennant was happy to second the proposition.

The President.—As Mr. Coleman, who was better acquainted with the powers of the meeting than himself, said it was in order and according to precedent, he would inform the meeting that it was proposed by Mr. Coleman, seconded by Mr. Dennant, that a Committee, consisting of Mr. Tomes, sen., Mr. Rogers, and Mr. Cartwright, be appointed to consider the statement respecting the specimen of Mr. Rodway; the said Committee to report at a future meeting the result of their investigations.

The proposition was put to the meeting and carried unanimously.

Mr. Charles Tomes, as curator, had to present to the Society, a specimen of the pharyngeal teeth of a tench which Mr. Petty had prepared for and given to the Society.

Mr. Oakley Coles, as one of those who had taken part in the discussions of the last meeting, having received his proof from Mr. Coleman naturally concluded that that gentleman had become the editor of the "Transactions." But in the absence of any general information on the part of the Society of any such change, he would ask the President whether such were the fact, so that if it were they might place on record a vote of thanks to the late editor, Mr. Sercombe, who, for the past three years—he thought he might say the whole of the period in which the "Transactions" had appeared in their present form—had edited their proceedings in, and he was sure all who knew anything of the working of the Society would agree with what he was going to say, a most able manner.

The President understood Mr. Coles to ask whether a change had taken place in the editorship of the "Transactions." He regretted to say that Mr. Sercombe, after acting as editor for three years, had felt it necessary to retire from the post. The Council were very sorry to lose Mr. Sercombe's services, which had always been willingly given, though at a great loss of time and rest, and had resulted very beneficially to the interests of the Society. Mr. Coleman had become the editor. He trusted Mr. Coles's proposition would be seconded.

Mr. Fletcher was most happy to do so.

The President was sure there could be no better judge of the value of Mr. Sercombe's labour than Mr. Fletcher, who, in past years had so well and efficiently done similar work for the Society. He had much pleasure in putting Mr. Oakley Coles's proposition, which had been seconded by Mr. Fletcher, "That the hearty thanks of the Society be awarded to Mr. Sercombe."

The announcement that the motion was carried *nem. con.* was received with acclamation.

Mr. Hutchinson had much pleasure in presenting to the Society some models taken from specimens in the Museum of the Royal College of Surgeons, with the kind permission of

Professor Flower. These had been selected chiefly on account of their rarity and peculiarity, and were not as yet represented in the Society's Museum. The first specimen was a model of the half of the lower jaw of the *Galeopithecus*, in which the incisors were finely divided, like the teeth of a comb; and, although each was only one-eighth of an inch wide, it had ten distinct divisions. It had been said that the animal made use of these peculiar teeth to comb its fur, but this does not seem very probable, on account of their extreme delicacy. Another model was of a single tooth and part of the upper jaw of the *Thylacoleo*, an animal classed as an extinct marsupial, whose fossil remains were found about eighty miles south-west of Melbourne, and described by Professor Owen as of undoubtedly carnivorous type, *Thylacoleo carnifex.* This inference has not received confirmation at the hands of other zoologists, for, in a paper which appeared in the "Transactions of the Geological Society," about 1869, Professor Flower, by comparison with existing species, showed that it was more nearly allied to those of a frugivorous type; because, in the first place, the teeth in the front of the mouth were not set widely apart as in carnivora, and therefore not adapted to seize and hold the prey; secondly, the blade-like tooth, from its position in the mouth and its shape, was unsuitable for prehensile purposes; thirdly, this tooth does not resemble true carnassial teeth, which are deeply notched in both jaws; but it has a straight edge, and no tubercle; lastly, comparison of the blade-like tooth with that in the model of the *Hypsiprimnus*, and of those in the front of the mouth with the *Phalangista* (already in the museum). shows how nearly the *Thylacoleo* resembled these animals, whose frugivorous habits are well ascertained.

The PRESIDENT complimented Mr. Hutchinson on the beauty of his models, and asked whether they were intended for the museum.

Mr. HUTCHINSON.—Yes, if they are acceptable to the Society.

Mr. CHARLES S. TOMES had to announce that he had received a letter from Mr. Eden, of Brisbane, stating that he had sent the Society several skulls of Australian mammals. As they had not yet arrived, he could give no description of them; but

he might say this was an answer to a begging letter inserted in the November number of the *British Journal of Dental Science*, and that their foreign brethren were putting them to shame in the matter of contributions to the Museum.

The PRESIDENT.—The Librarian wishes me to mention that if any member desire to complete his set of the Society's Transactions, it will be advisable he should do so without delay. The volume for 1867–8, being Vol. VI., is, in fact, already out of print, and cannot be procured; and members are strongly recommended to purchase any of the other volumes they may require, whilst they are still to be had. The cost to *Members* is as follows, *being cost price*:—

Vol.	I.	(1856–7)	5*s.*
,,	II.	(1857–60)	10*s.*
,,	III.	(1860–3)	10*s.*
,,	IV.	(1863–5)	10*s.*
,,	V.	(1865–7)	25*s.*
,,	VI.	(1867–8)	No copies left.

New Series:—

Vol.	I.	(1868–9)	17*s.* 6*d.*
,,	II.	(1869–70)	17*s.* 6*d.*
,,	III.	(1870–1)	19*s.* 6*d.*

They can be purchased at this price from the sub-librarian on *personal application*, as it would not, of course, be possible for the Society to undertake postal arrangements. Country members wishing to purchase them should request a London friend to apply for them. The Librarian will be glad to purchase a copy of No. 172 of the *British Journal of Dental Science* from any gentleman who may possess a duplicate copy of that number. It is the number for October, 1870. The library is now closed for the purpose of inspection, and members having books in their possession are requested to return them at their earliest convenience.

Description of a Lower Jaw, the Development of the Left Ramus of which has been Arrested. By CHARLES S. TOMES, Curator of the Museum.

MR. PRESIDENT AND GENTLEMEN,—

THIS very remarkable specimen was, as I am informed, placed in the Museum by the late Mr. Hulme, but of its history nothing whatever is

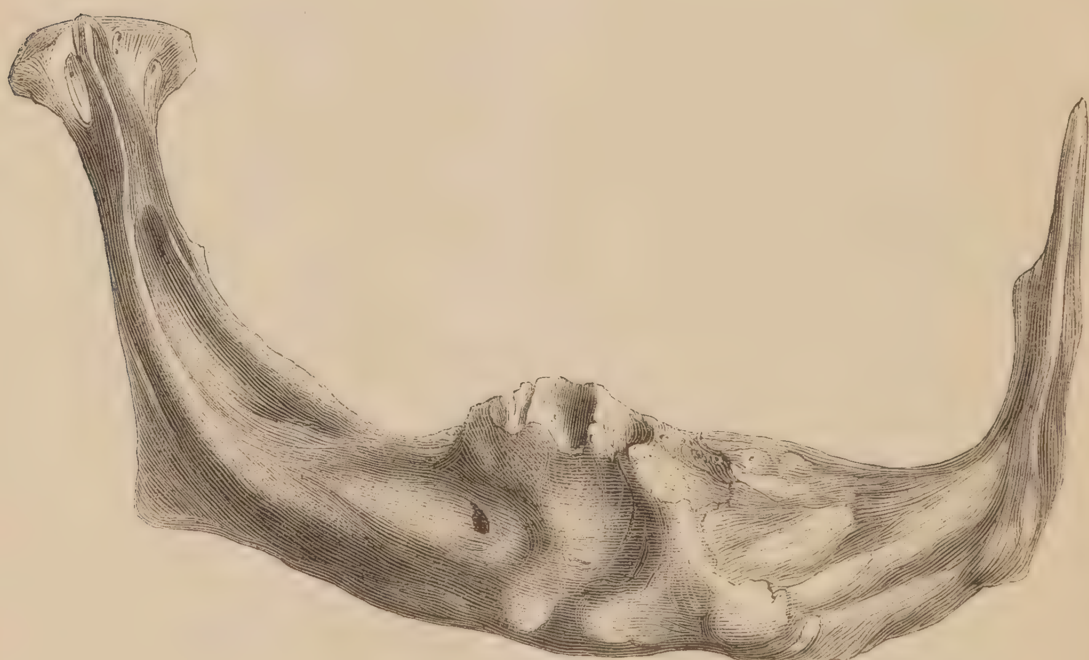


FIG. 1.

known. In the "Transactions of the Pathological Society" for 1861, a somewhat similar case was figured and described jointly by Mr. Edward Canton and my father. In that instance the patient, who was in other respects stunted and

unhealthy, died at the age of sixteen; but, judging from the character of the jaw now before us, in this case the patient must have reached an advanced age.

Viewing the jaw from the front, the left side is seen to be greatly stunted: it is, in fact, far smaller than it appears to be when looked at from the front—this view being misleading, from a cause to be presently noticed. The horizontal ramus is apparently no longer than that of a child two years of age, though posteriorly it is impossible to say where it ends and where the ascending ramus commences, for it gradually dwindles down to an upward-curving spinous process. This long spine appears to be in continuity with a trace of the external oblique ridge, and in that case must be regarded as the representative of the coronoid process. On its inner side, about half-way up it, is a process which probably gave attachment to muscles, or perhaps to the internal lateral ligament, if this existed. There is not a vestige of a condyle or articulating surface; and on examining its inner side, no trace of the inferior dental foramen can be found; as a matter of course, it follows that there is no mental foramen. The vascular supply of this side of the jaw was derived from several small vessels entering the front of the jaw on its inner and outer aspects.

On looking at the jaw from below, the tubercles which give attachment to the genio-hyoid and

genio-hyo-glossus muscles are found not to correspond to the position of the mental prominence on the outside of the jaw, which latter lies considerably to the right of the former. It is

FIG. 2.

impossible to doubt that the position of the genio-hyoid tubercles mark the median line of the body, as they give attachment to muscles which enter into relation with distinct and important structures at a distance from the jaw, whereas the mental prominences, giving attachment to facial muscles, will participate in that unsymmetrical development of the face which must of necessity have existed. Hence this left ramus is really shorter than it appears to be when seen from the front, where the mental protuberances would be taken as indicating the median line.

In this specimen the teeth have all been lost; at the front there are the empty sockets of four single-rooted teeth, whilst behind them the appearance of the alveolar margin leads to the inference that other teeth had existed, and that their sockets had been removed by absorption after the teeth were lost. But the space is wholly insufficient to have lodged the normal number of teeth on the left side, in this respect differing from the specimen described at the Pathological Society, in which the whole of the permanent teeth, with the exception of the wisdom-tooth, were in place. It is almost impossible to say what has led to this abortive development of one half of the jaw in these two cases, whilst the other half has attained its normal size and shape.

It is noteworthy that in each case the left side of the jaw was stunted, and that in the present specimen there is no vestige of a canal for the vessels, whilst in the other the canal was very small, and did not emerge at a mental foramen, but was lost in the bone. It is possible that some abnormality in the vascular supply may have brought about this state of things, by, as it were, starving the bone; but, on the other hand, the small vascular supply may have been a consequence, and not a cause, of the small size of the bone. But one point seems perfectly clear: the actual manner in which the growth has been arrested was the cessation of ossification in the

articular cartilage, this, as was pointed out by Kolliker, being the principal means by which the backward elongation of the jaw is accomplished; hence the absence or destruction of the articular process in the case of the lower jaw of necessity arrests its growth in that direction, whilst its vertical development, which is in direct relation with the formation of the teeth, is but little interfered with.

The PRESIDENT then called upon Mr. C. S. Tomes to read his Paper.

On the Chemical and Physical Properties of Amalgams. By Charles S. Tomes.

Mr. President and Gentlemen,—

It is not my intention in this paper to enter into a discussion on the relative value of amalgam and other fillings, but, believing as I do, that every practitioner has occasion to use amalgams in certain cases, I propose to confine myself strictly to the examination of their properties. That they are, on the whole, unreliable and unsatisfactory, even where every care has been taken in their application, is a point on which all, or almost all, are agreed; but, on the other hand, their occasional success leads us rather to examine somewhat minutely their real character, than to wholly abandon them as not susceptible of improvement.

But as I do not know of any place where the facts already known as to the nature of amalgams are to be found in a collected form, it seems necessary to briefly summarize the present state of knowledge on this subject, before proceeding to describe the experiments which induced me to write this paper.

The great majority of metals, when in a state of fusion, are capable of entering into chemical combination with one or more other metals; such compounds, which are familiar to us under the name of alloys, are shown to be chemical compounds and not mere mechanical mixtures, by such phenomena as alterations in their specific gravity, alterations in their melting-point, evolution of heat at the moment of combination, and other manifestations of the like character. Now, the first point to be borne in mind is that an amalgam is simply an alloy in which mercury is one ingredient; and that mercury, in the formation of its alloys, does not markedly differ from other metals, save that its fusing-point is so low that it is in a state of fusion at ordinary temperatures.

As amalgams and alloys have already been stated to be chemical compounds, and not mere mechanical mixtures, it follows that in all true alloys, whether of mercury or other metals, the different constituents must be present in atomic proportions. But, like all other chemical compounds between bodies of very similar properties (and from a chemical point of view the metals are all very similar), the components of the alloy are only held together by feeble ties; so feeble that, for example, in the case of mercury united in atomic proportions with other metals, the alloy may often be decomposed by the mere

pressure of a hydraulic press, and pure mercury squeezed out. Moreover, alloys do not as a rule present extremely marked differences from the constituent metals,* but present some general resemblance to these ; and it is practically found that, although the constituents of a *true* alloy must be present in atomic proportions, the alloy dissolves perfectly (with a few exceptions) in an excess of either metal whilst in a state of fusion ; and the resulting mass differs almost imperceptibly from an alloy which is a true chemical compound so far as the proportion of its constituents are concerned. For our present purpose this is an extremely important fact ; for if an excess of the one metal or the other did greatly alter the resulting mass, we could never hope to get anything approaching to constant results in mixing up our amalgams. To get a theoretically perfect chemical compound, each metal present must bear its atomic proportion to the others before the mercury is added, and the mercury must be just such a quantity as will afford an equivalent to the metals present. But such an exact weighing out of our materials

* Of course it is not meant that the properties of metals are in no way altered by alloying them with others, but only that the resultant alloy will partake in some respects of the characters of the metals of which it is made up, which are not wholly disguised in the formation of an alloy, as they would be in combining with an acid to form a salt.

would be obviously impracticable; moreover, in order to be able to use the amalgam, we must have it in a more or less plastic condition. Now, mercury being the only one metal which is in a state of fusion at ordinary temperatures, what we practically do is to get an alloy of mercury and certain other metals dissolved in an excess of mercury. I have entered into this question of atomic proportions here, because it has been often stated that we must use metals in these exact proportions if we hope to succeed, and this point has been recently urged by Mr. Fletcher, in a paper in the February number of the "British Journal of Dental Science." But although on general grounds we are able to state that slight excesses of the one metal or the other will not greatly alter the amalgam, there are several objections to having a *very great* excess of mercury.

For when mercury holding in solution a small quantity of foreign metals is agitated with air or water, a blackish-grey powder is produced, which consists of a mixture of the oxides of the foreign metals with very minute globules of metallic mercury: the mercury does not, as has been erroneously stated, itself undergo oxidation. It is on this fact that the familiar process of purifying mercury by shaking it up with powdered sugar (which entangles these oxidized metals) is based; and remembering the fact of their being

rendered susceptible of oxidation by solution in a large excess of mercury, we should expect them, as is indeed the fact, to be rendered more susceptible to other chemical influences, and hence avoid any great excess of mercury in our amalgams.

Moreover, amalgams which contain any great excess of mercury lose some of it by evaporation, even at ordinary temperatures.

The exact nature of the process by which an amalgam hardens is wrapped in some little obscurity; some, which have become perfectly hard, are again rendered plastic by simple pounding, again becoming hard, and apparently crystalline, when left in a state of rest. Some soften when heated, whilst others remain unaffected by heat. But, anomalous as the behaviour of amalgams seems with regard to hardening, it is not much more so than the behaviour of many alloys into the composition of which mercury does not enter. Many of these present a wide difference between the point at which they fuse, and that at which they again solidify.* Hence it is possible that the cause of the hardening of amalgams may not be, as seems the general impression, a sort of crystallization; but rather that the chemical combination by which the excess of mercury is taken up by the metals with which it is in contact is slow, and that heat or mechanical forces

* Matthiessen, British Association Report. 1863.

may destroy this chemical combination, which takes time to re-form itself again.

Turning from these general considerations as to the nature of amalgams, to their behaviour in the mouth, the first point on which there seems to be some little difference of opinion, is as to the manner in which the teeth become stained. I have examined a large number of teeth stained by amalgams, as well as the blackened surfaces of the fillings themselves, and I have uniformly found that the discoloured tissue contains metallic sulphides; and I have found no mercury in the stained tooth-substance, so that I infer it is the other metals which are acted on in the mouth, and not the mercury. But of this I am not absolutely certain, as the total quantity which can be obtained for experiment is so extremely small. As is well known, copper amalgam stains a tooth more deeply and more widely than any other in ordinary use; and a possible explanation of this fact has occurred to me, though I am not sure whether it be the true one. The sulphide of copper, under the influence of exposure to air and moisture, readily becomes oxidized, and forms the sulphate. Hence it is almost certain that we shall have sulphate of copper formed upon the exposed surface of the filling; now, this sulphate is freely soluble, and hence is likely to permeate the dentine, where it will again be slowly converted into sulphide, whilst the sulphides of other

metals, not being so readily converted into soluble salts, will not so thoroughly permeate the tooth.

Passing now to the subject of the failure of amalgam fillings, the most instructive examples will be found in those cases where a gold filling should have been inserted, and where it would probably have succeeded—such as crown cavities in molar teeth. When such fillings are removed, decay is commonly found to have progressed, perhaps only to a slight extent, all round the cavity; on lifting out the detached plug, the whole bed in which it had rested is found soft and discoloured. Now, if a gold or a tin filling which has failed under similar circumstances be removed, although caries has gone on at one or more points, unless it has proceeded to a very great extent, some parts of the cavity are found to have been efficiently protected, and to require no further excavating.

Here, then, is a point of difference, very commonly, though of course not invariably, observed between amalgams and other fillings: in the case of the amalgam, the failure is commonly general all round the plug, whereas, in other fillings, it takes place only at isolated points.

Seeing that the surface of an amalgam filling does not, as a rule, waste much from chemical action, one is led to doubt whether the failure of such fillings is really due to the disintegration of the amalgam, or whether it is not more probable

that it has never at any time formed a perfect plug; that is to say, never been in perfect contact with the walls of the cavity all round its circumference.

It is very common to see the edges of an amalgam plug standing up somewhat above the level of the edges of the cavity, and this has often been supposed to be an evidence that the amalgam had expanded as it hardened; but I think that this appearance is susceptible of a widely different interpretation: in fact, another interpretation is a necessity; for, as I shall presently show, none of the amalgams in every-day use do expand.

When a soft plastic mass is pressed into a cavity, and its surface smoothed, its edges are very apt to overlap the sound tooth-surface around the cavity, and this is almost certain to happen where the tooth is irregular in form, as, for example, on grinding surfaces. In the case of a gold filling this does not much matter, but in the case of amalgams it is objectionable; for they are all rather brittle and friable, and these overlapping portions, being very thin, speedily break off or crumble, leaving the appearance just alluded to of the filling standing up above the edge of the cavity.

In the angle formed between the abrupt edge of the filling and the surface of the tooth will be a groove, well calculated to afford a lodgment for fluids and other matters; and if we add to this an

imperfect adaptation of the amalgam plug to the wall of the cavity, we have a condition of things which will almost ensure the early decay of the tooth round a considerable part of the plug. Believing, then, that chemical action on the amalgam would not account for the very general failure of such fillings, especially as those which are most successful, namely, palladium and copper amalgams, are those which become most completely blackened on their surface, I went on to experiment on the possibility of getting perfect adaptation to the walls of the cavity in an amalgam filling.

The first point to ascertain was whether any change of bulk takes place while a filling hardens; and if so, whether that change was contraction or expansion. On this point the most various opinions prevail; for instance, in "Watts's Dictionary of Chemistry," the standard book of reference on the subject, I find the statement that copper amalgam has the same density when hard and when soft; that is to say, does not contract or expand in setting.

In the discussion following the late Mr. Laurie's paper on "Plastic Fillings," will be found a statement that some amalgams expand in hardening, and may even, in this way, split off portions of enamel; whilst in Mr. Fletcher's paper it is stated that the addition of platinum to the ordinary silver and tin amalgams prevents their shrinking as they set.

In the face of a number of irreconcilable statements on this matter of expansion and contraction, I commenced a series of experiments to determine what were the facts; but before proceeding to the results of these experiments, I will briefly describe the manner in which they were made. The plan pursued is that by which specific gravities are taken. The piece of amalgam which is to be experimented on is suspended by a hook, on the end of a very fine platinum wire, from one pan of an exceedingly delicate chemical balance, which would turn distinctly for one-thousandth of a grain. The amalgam was immersed in a vessel of distilled water, the temperature of which was carefully noted, and then weighed as soon as possible after it had been mixed up; after the lapse of twenty-four hours, it was again weighed. Of course, during this time, its absolute weight could not have changed; but should it have expanded, it would displace more water, and so apparently weigh less—*i.e.*, it would take a less weight in the opposite pan of the balance, because it would be buoyed up more by displacing more water, and *vice versâ*. By also weighing it in air, we are enabled to determine its specific gravity, or, by a simple calculation, to estimate the actual change in bulk (if any), which has taken place. Of course, a number of precautions have to be observed in making these experiments, with which I need not here detain you; but if all possible

precautions are taken, the method will give results of an extreme accuracy, bounded only by the sensibility of the balance. The balance with which these experiments were performed, is one of unusual delicacy,—a delicacy, in fact, in advance of our requirements in this matter.

As a preliminary experiment, I took portions of Sullivan's, Ash's, and Rutherford's amalgams, and mixed them up as thickly as they could conveniently be used; in every one of these contraction, as indicated by an increase in weight when they were weighed in water, took place during their hardening: and this contraction was no infinitesimal quantity, but in one instance was as great as 1-45th of the whole bulk of the mass.

Seeing that such a contraction as this taking place after the completion of the filling must almost inevitably result in the formation of a minute fissure all round the plug, the next experiments were devoted to the determination of the period at which this contraction took place; the annexed tables show this with Ash's and Rutherford's amalgams.

In these tables, as in the others which I shall place before you, the figures given are not the actual amounts of contraction, but the apparent changes of weight actually observed, which serve the present purpose just as well, and save a considerable amount of calculation.

TABLE I.

Rate of Contraction in a Hardening Amalgam.

Ash's Amalgam, mixed up as thickly as it could conveniently be used.

After the lapse of Hours.	Min.	Gain in weight in 100 parts during each successive period of time.
0	30	·04
1	15	·05
2	0	·03
2	45	·027
3	30	·01
4	15	No appreciable gain.
12	0	·037
24	0	No gain.

TABLE II.

Rutherford's Amalgam, from which the excess of mercury had been squeezed out, till it was so dry as to necessitate the use of a warmed instrument to form it into a solid lump.

After the lapse of Hours.	Min.	Gain in weight in 100 parts during each successive period of time.
0	10	·07
0	30	·06
1	0	·1
2	0	·1
5	0	·17
10	0	No increase.

These tables agree in showing that the contraction is at first rather rapid, and that a certain amount of this contraction is over before the amalgam is sensibly hardened, but that it continues for many hours; in the case of Ash's

amalgam for something between six and twelve hours, and in the case of Rutherford's for five hours only. The greater rapidity with which the contraction of this latter took place was, as determined by comparative experiments, due to its having been used very dry. But in both cases the contraction was continuing long after the time that the filling would have completed.

The next series of experiments was devoted to the comparison of differences shown in the contraction of the same amalgams when mixed with greater or less quantities of mercury. As my object at this stage was merely to get some idea what effect excess of mercury would have, the quantities of mercury were not weighed out in every instance; but I may mention that in those amalgams which were mixed thin, the weight of mercury was more than twice that contained in those samples which were made as dry as they would cohere together.

TABLE III.

Table of increase in weight in 100 parts of the same Amalgam, used with varying quantities of mercury.

Sullivan	Rather thin	·068
	Very dry	·3
Rutherford	Rather thin	·2
	Medium	·18
	Very dry	·4
Ash	Thin	·16
	Medium	·24
	Dry	·16

An inspection of the figures in the foregoing table, which were confirmed by several comparative experiments, will render it at once apparent that, so far as shrinkage is concerned, no general statement as to the effect of the amount of mercury present can be made, as the results obtained with different amalgams give inconsistent results; but I should note that in the case of the Ash's amalgam, which was mixed very thin, the hardening was not very perfect.

As there did not seem much hope of success by pursuing this line of inquiry further, my next experiments were devoted to investigating the relative shrinkage of different amalgams, placed as far as possible under similar conditions. In the ensuing tables the amalgams were employed of such a consistency that they could just be made to cohere into a solid lump by the fingers.

TABLE IV.

Comparison of the weight gained by different Amalgams.

Palladium	·037
Sullivan (medium)	·07
Ash	·14
Smale	·14
Tin and silver (55 to 45)	·35
Tin and silver *āā*	·38

In this table it will be noticed that palladium enjoys a marked pre-eminence, its contraction not being more than half that of Sullivan, which from this point of view is next best: while the

amalgams composed solely of tin and silver, of which a great number are sold differing very little from one another, show a much greater amount of shrinkage. It is to my mind exceedingly satisfactory that purely theoretical considerations should have placed them in this order of merit; for I think it is exactly the order in which the practical experience of most persons would arrange them. Every one who has made use of Palladium for any length of time speaks most highly of its efficacy: while there is a very general belief that Sullivan's amalgam is good, save that it discolours the teeth so much as to greatly limit its usefulness. Again, it sometimes happens that Ash's amalgam preserves a tooth for a considerable length of time (though it is but rarely that it does so), whereas those composed of silver and tin alone have little to recommend them.

The foregoing table, while it affords much support to the idea that it is the shrinkage of amalgams that leads to their failure, shows that none of those in ordinary use are free from this defect. But it does more than this; for it seems to afford some clue to a means of lessening this shrinkage. It will be noticed that Ash's fillings, which behave very much like tin and silver, and are in fact mainly composed of these metals, nevertheless do not contract so much as those placed below them.

Selecting, then, a proportion of tin and silver which I knew to shrink greatly in setting, I added to it increasing quantities of gold, with the result given below.

TABLE V.

Silver 4·5, Tin 5·5			·33
Silver 4·5, Tin 5·5	+ Gold	1	·16
Silver 4·5, Tin 5·5	+ Gold	2	·086
Silver 4·5, Tin 5·5	+ Gold	3	·055
Silver 4·5, Tin 5·5	+ Gold	4	·037

This table shows conclusively that the addition of gold has a power to hinder the contraction; but there is a practical limit to its use, as after the gold reached the proportion of 4 parts in 10, the amalgam did not harden well.

Moreover, these amalgams kept a beautifully bright surface, retaining very minute impressions; so that, within moderate limits, the addition of gold effects a very definite improvement, the gain in weight during setting indicating only a very slight shrinkage in the last specimen there examined. But I fear that this amalgam is not sufficiently hard to stand well in the mouth, and it is possible that the diminution in shrinkage may be simply due to the amalgam hardening less perfectly.

Platinum is a somewhat difficult metal to form an amalgam with; spongy platinum will unite with mercury when rubbed with it in a hot mortar, but platinum in the compact state will not. But when alloyed with somewhat more than its own weight of tin, it readily unites with the mercury: it does not, however, set very hard, and the more tin is added the softer the amalgam remains. With silver alone it does not, in any proportion that I have tried, form a homogeneous paste when rubbed with mercury; but if silver be added to the alloy of platinum and tin, it confers on the amalgam the power of hardening. This addition of platinum to mixtures of silver and tin accelerates their setting, but does not, as has been recently stated, prevent their shrinkage: it does, however, apparently tend to diminish it. An amalgam consisting, I believe, of platinum, tin, and silver, has been lately sold under the name of platinum amalgam; it is, however, by no means free from the defect of contraction in setting. Nevertheless, I think that there is some chance of getting a really good platinum amalgam, although I am not in a position at present to recommend strongly any one formula. My experiments are, however, still in progress, so that I hope, at some future time, to be able to do so.

But at present, notwithstanding the inconveniences attendant on its use, I believe palladium

to be the best amalgam at our disposal. To what extent it really contracts in setting it is almost impossible to determine, as its setting and its shrinkage are so exceedingly rapid, that both are often complete before it has been possible to weigh it: moreover, the amount of heat set free during the combination of mercury and palladium is very considerable, so that it is not certain whether the temperature of the lump of amalgam exactly coincides with that of the water at the time of the experiment.

But this much is quite certain — that no contraction to any noteworthy extent takes place after the first few minutes; so that no further change ensues after the completion of the filling. And it appears to me that this is the true explanation of the success attendant on the use of palladium; for it becomes blackened on its surface, and even after a time may slightly stain the tooth (though it does not commonly do so), so that it is clearly susceptible to some extent to the chemical influences at work in the mouth. Still, though I believe it to be the best amalgam hitherto used, it is very inconvenient, on account of the rapidity with which it sets; and the blackening of its surface is a decided objection to its use in some parts of the mouth.

With the alloys of palladium and silver and tin, I have not any satisfactory result to record.

The use of tellurium amalgam has lately been

advocated by Mr. Fletcher. Berzelius mentions that it forms an amalgam with mercury, but does not give much information as to its stability; and the experiments which I have lately made, do not lead me to endorse the favourable opinion which has been expressed upon its applicability to dental purposes.

My object in writing the present paper has been to endeavour to clearly lay down the conditions that must be fulfilled by a really good amalgam, and to demonstrate, by actual experiment, that the contraction which takes place in every one of the amalgams used is considerable. To this contraction I believe the failure of amalgam fillings is generally due, and not to their disintegration by the fluids of the mouth.

The properties which must be possessed by a good amalgam are:—That it shall set sufficiently hard to withstand the wear of mastication; that it shall not be acted on by the fluids of the mouth; that it shall be of fine, smooth texture when soft; and finally—what is, perhaps, the most important point of all—that it shall not contract in hardening.

The metal which confers the property of hardening on many of the amalgams now in use is silver; and, perhaps, the hardening of a tin and silver amalgam may be explained in this way:—When first rubbed up with mercury, the tin entirely unites with it, and would form a perfectly

smooth paste, but that the silver does not so speedily dissolve; and thus the paste is somewhat granular, and lacks the smooth, greasy feeling which characterises Sullivan's and palladium amalgams in which the solution is complete. Then, as the silver gradually unites with the mercury around it, the mass hardens; but it also shrinks, for the combination of silver with mercury is always attended with condensation.

Hence it would be desirable to find some other metal which would confer on tin amalgam the property of hardening; and it seems probable that the use of silver must be abandoned if we wish to get a really perfect amalgam.

The second condition,—that it shall not be acted on by the fluids of the mouth,—is, perhaps, not absolutely attainable; but it must be borne in mind that there are several metals—such as platinum and palladium—which, when they are present in sufficient quantities, seem to protect the metals with which they are associated.

The third condition,—that it shall be of smooth texture,—precludes the presence of any large quantity of silver, and is best secured by the presence of a considerable proportion of gold, platinum, or tin.

The fourth condition,—that it shall not contract,—has been already more or less discussed; and I will only once again repeat, that on this

account the presence of any large quantity of silver is inadmissible.

Practically, then, it seems that we must banish silver from our amalgams in great part, if not entirely. The problem is to find some other metal which will confer hardening properties, as the alloys of tin with gold or platinum will probably fulfil the other conditions required. Probably an excess of mercury is injurious; but it must not be forgotten that the best of amalgams,—palladium, takes up a very large quantity of mercury (upwards of three times as much as would be required to furnish an equivalent of mercury); so that the presence of a considerable quantity of mercury is not of necessity an evil.

And if we fail to find a metal which shall confer hardening properties, whilst it is free from the objections urged against silver, then we must use amalgams, the setting of which is sufficiently rapid to be complete, or as nearly as possible complete, before the patient leaves our hands, so that the contraction may be over before we burnish down the filling.

Some of the experiments made with platinum and tin furnished beautifully smooth white amalgams, which might, I think, prove useful as temporary fillings. They keep their colour well, and become sufficiently hard, with the addition of a very small quantity of silver, to stand in any position where they are not much exposed to mastication;

and the fact that they do not shrink much, and that they remain soft enough to be readily removed with an excavator, would make them probably suitable for temporary fillings. But I have, as yet, no experience of their use in the mouth, so that I can only put forward this suggestion as a tentative one; and my reason for doing so at all is the decided opinion expressed at this Society by Mr. Thomas Rogers, that calcification of a pulp, almost or quite exposed, takes place more surely and more speedily beneath an amalgam filling than beneath any other.

Discussion.

The President was sure they had all heard with great interest Mr. Tomes's paper, which had gone very fully into the subject. He had not been aware that Sullivan's stopping contracted in hardening to the extent stated in the paper. There could be no doubt, however, that, next to palladium amalgam, Sullivan's was the best; but he greatly preferred palladium to any other. It contracted less, made a very reliable plug, and did not discolour the tooth. He would be happy to hear the opinion of members on the subject.

Mr. Oakley Coles thought, after the enormous labour it was evident Mr. Tomes had expended in preparing his paper it was only due to him and themselves to properly discuss it. He thought that they were very much indebted to Mr. Tomes, first of all for having taken up such a subject, and secondly, for going on with his experiments in the face of apparently unsatisfactory and negative results. The results that had been obtained had been placed before them most clearly and plainly. There was one curious point that Mr. Tomes had mentioned to which he would refer, viz., the fact of, in amalgams of silver and tin, an enormous amount of contraction. Some of the meeting would remember what strong stoppings used to be made of mercury and the ordinary precipitate of silver, and that such stoppings had been known to remain in the mouth for upwards of twenty years. The extreme discoloration—its chief defect—brought it into disrepute, as also the careless manner of its preparation, and other manifest imperfections. But the fact of its previous use seemed to contradict the experiments of Mr. Tomes, and he thought the point merited an explanation. In conclusion, he could but repeat those words with which he had commenced, and to add that, as gold could not always be used, it was desirable to use that amalgam which presented itself in the most perfect form.

Mr. Harding said it seemed, from what he had heard, that palladium was the best amalgam, but that it was not the most

practicable to use; and that, after all, we must fall back upon Sullivan, pronounced by Mr. Tomes's father to be the best of amalgams. If palladium could be more easily obtained, it was undoubtedly the best, and he thought the consideration of expense should not prevent their using the best material; for, after all, the difference would be scarcely appreciable. If members, however, would do what it was evident none of the depôts meant to do,—take up the question and find out how it could be procured, that difficulty would soon be removed. But he was very glad to find, from Mr. Tomes's experiments, that we could not obtain a perfect amalgam; for if they could, the practice of gold filling would very soon, in a measure, be given up, and the aim and object of their work at that hospital, which was that gold should, if possible, be the material used for filling would also have to be given up.

A Member would like to ask Mr. Tomes whether he had made any experiments with aluminium, and whether it was malleable enough to form a leaf stopping. He thought its freedom from oxidation would render it very useful if it could be used.

Mr. Dennant thought the applause which had greeted Mr. Tomes's paper proved how welcome it was to the Society, and might be taken as an indication that papers dealing with the subjects of everyday practice in a scientific yet practical manner, were most acceptable; and Mr. Tomes was entitled to their best thanks for the patience and care he had evinced in the conduct of those experiments which had yielded such practical results. It was evident that palladium, as a non-contractor, must rank first among amalgams; but then there was difficulty in procuring it of uniform quality, and again its expensiveness would, he feared, in many instances prove a barrier to its use. Upon a reference to the tables before them it would be seen that tin and silver, with the addition of 40 per cent. of gold, exhibited as little contraction as the palladium, and would be less costly and of course easily prepared. This interesting paper was of great service, inasmuch as it showed most palpably the mistake of employing amalgams too much for stoppings, and it would confirm them all in the view that it was im-

possible at present to supersede gold as a sound and permanent filling.

Mr. Charles S. Tomes said that, so far as he knew, aluminium was not a suitable metal for foil fillings, and he did not think that any use could be made of it as an amalgam. The inconveniences attendant on the use of palladium, from its high price, the varying behaviour of different samples, and the rapidity with which it becomes too hard to be used, rendered it very desirable to find some substitute for it. Although many of the requirements were satisfied by amalgams very rich in gold, he feared that these would not prove sufficiently hard for durability. He did think the fact mentioned by Mr. Coles tended to disprove the inferences he had drawn respecting the use of silver in amalgams. It must, however, be remembered that silver in the compact form, as it would be in filings, was slow to combine with the mercury; and hence the long-continued contraction of the amalgam; but this does not apply so fully to precipitated silver, which is in a state of very fine division. This would combine with the mercury with far greater rapidity, as was in fact indicated by the observation made long ago, that precipitated silver took far more mercury to make it into a plastic mass than filings. This is probably due to the fact that in the one case combination takes place almost at once, in the other only after some time. And if it be admitted, as he thought it must be, that combination takes place more quickly in the case of precipitated silver than in that of filings, this alone is sufficient explanation of the occasional durability of these stoppings, to which Mr. Coles had alluded. In point of fact, we should have one of the advantages attendant on the use of palladium, *i. e.*, the advantage of *comparatively* little change going on after the filling is completed.

The President.—I have now to thank Mr. C. S. Tomes for his two papers, Mr. Rodway for his communication, and Mr. Petty and Mr. Hutchinson for their presentations to the Museum. The next meeting of the Society will be held on the 1st of April, when a Paper will be read, entitled, "Additional Remarks on Inostosis," by Mr. George Henry.

GENERAL MONTHLY MEETING,

Monday, April 1, 1872.

THOMAS UNDERWOOD, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentleman was proposed for Membership of the Society :—

Mr. Thomas Percy Sheffield, of Shirley Street, Portman Square.

The President announced the following donations to the Library, from Dr. Belisario :—

Several copies of the Report of the Trustees of the Australian Museum (1870–1871).

Four copies of "The Snakes of Australia" (Dr. Krefft).

Copies of a paper on Australian Vertebrata, Fossil and Recent (Dr. Krefft).

Several copies of a List of the "Australian Longicorns" (Messrs. Pascoe and Masters).

Several copies of a Guide to Australian Fossil Remains (Dr. Krefft).

Presented by Mr. Thomas and Mr. Henry Rogers, two copies of the "Transactions of the Odontological Society," 1867–1868.

The Hon. Librarian announced that the Catalogue of the Library was in the hands of the printers, and that as soon as it was completed the Library would be open for the use of Members.

The following gentlemen, viz., Mr. John Fairbank, M.R.C.S., and Mr. William Caleb Williams, could not be balloted for

in due course, owing to the number of members present being insufficient, according to the by-laws.

Mr. Coleman had been requested by Mr. Drury, of Dover, to present to the Society a portion of the superior maxilla of human remains found buried in the chalk of Dover Castle. The specimen had been dug out in company with the greater portions of seven skeletons, buried apparently without coffins, and generally supposed to be the remains of French prisoners of the date of 1706, though some attributed to them a much more remote date. There was no great interest in the specimen further than in the excellence of the teeth, which, if for not all their patients, they might covet for themselves. Reverting to another subject, viz., Mr. C. S. Tomes's paper of the last Meeting, the discussion upon which he was unable to be present at, he should like to remark that some years ago he tried the following experiment with amalgams, viz., filling cavities in teeth removed from the mouth, and then, after some days, examining them by magnifying power. In some cases, he distinctly found that the amalgams were no longer in contact with the walls of the cavities, and that, moreover, they projected from the cavities. He consequently came to the conclusion that some amalgams in hardening have a tendency to assume a spheroidal form. He thought, if his impressions were correct, they would explain a fact pointed out at the last Meeting, viz., that some of Mr. C. S. Tomes's experiments did not accord with the results of actual practice. An amalgam which altered its form in becoming hard might give no alteration between its specific gravity in the soft and hard condition, and yet, from the circumstance named, be a very unfit material for use. He made these observations especially as Mr. C. S. Tomes had intimated that he was continuing his experiments, and he should like to call that gentleman's attention to the circumstance.

The President.—What amalgams did you experiment upon?

Mr. Coleman.—I believe they were Ash's, the American (White's), and Sullivan's. In the latter I found no such change as I have described.

Mr. Fox exhibited a new form of articulating frame, invented by Messrs. Graham & Wood, of Stockton-on-Tees, the chief advantages of which were its solidity and the facility with which the model could be removed from, and replaced on, the frame as required.

Mr. Hutchinson brought before the Society a case of calcification of the pulp of an upper molar tooth extracted by Mr. Alexander Fothergill, of Darlington. The special interest attached to it would be gathered from the history; for the patient, a girl of about fifteen, had suffered from severe continuous pain in the first upper molar of one side, but finding no trace of decay, Mr. Fothergill attributing it to the remains of nervous pain caused by the extraction of a lower molar, objected to remove it, and gave her palliative treatment. She returned after some time and begged its removal; and as it gave evident pain on percussion, it was extracted, and on its being broken open, the pulp occupying the crown of the tooth was found almost completely calcified, loosely filling the space. On

Section of Calcified Pulp, showing Dentinal Tubules cut transversely, with their ramifications.

making a thin section from its surface, Mr. Hutchinson found it possessed well-marked characteristics of secondary dentine, very irregularly developed. The patient called a few days after to say that all pain had ceased after the operation. She had lost no upper tooth previously, and all were perfectly

sound and regular, but seemed very close together. This makes the case more singular, for Mr. Tomes refers to many cases, and they are frequently met with in practice, where irritation or inflammation of the pulp induces calcification of it; but here the absence of all caries, and the extreme youth of the patient, make the explanation more uncertain. It might either be due to irritation set up by the lateral pressure, or else to external irritation reaching the cornua of the pulp, which run high into the cusps, by means of a fissure in the enamel from arrested calcification.

The PRESIDENT said he once had a tooth which gave him most acute pain, from being broken in an attempt to take it out. He had it dressed with arsenious acid. After twenty-four hours, all pain ceased, and the tooth lasted for two years. At the end of that time he had it removed, and on examination found it to be one of the most remarkable cases of calcification he had ever seen.

Fig. 1.

Wyman & Sons, Gt Queen St W.C.

Additional Remarks on "Inostosis."

By George Henry, L.D.S.

Mr. President and Gentlemen,—

Having met with some interesting specimens of Inostosis since my communication on this subject, read before the Society in December last, I am desirous of offering the results of further observation as a supplement to that paper, prefacing them with a description of sections, which I have prepared for the microscope.

No. 1 is a longitudinal section of a primary molar, which had been retained in the jaw long after the eruption of the permanent set of teeth. The periphery of the dentine of the remaining fang (Fig. 1, *a*) has suffered to the extent of three-fourths from absorption, leaving at the upper fourth a trace only of the original cementum with its contiguous granular layer. Marked inostosis, encroaching on the regularly-distributed dentinal tubuli at all points, has occupied the place of the lost tissue (*b*).

This section further presents a remarkable condition of structure in the body of the crown, being perforated in several places, and exhibiting around these perforations osseous layers of

variable thickness, mostly charged with lacunal cells; thus presenting a similarity to the Haversian systems of true bone. The slight wavy translucency surrounding these osseous patches, appears to be a line of demarcation left by absorption; and the peculiar osseous formation points to a similar origin to that of the inostosis of the root, by way of the pulp-cavity, which had been doubtless occupied by the advancing absorbent organ.

No. 2 is another longitudinal section taken from the same tooth, exhibiting more extensive loss from absorption, and is especially interesting as showing the secondary dentine to have been intruded on by "penetrating inostosis," the osseous systems in turn undergoing absorption, and several canals still contain the colouring matter of the blood.

No. 3 is part of a longitudinal section of a permanent bicuspid with "superficial inostosis," at the apex of the fang, of which I have given an outline (Fig. 2). The festooned translucent line showing the extent of former absorption (*a*, *a*) may be traced under the microscope continuous with the exterior of the original normal layer of cementum on either side, and seen to dip with its characteristic wavy course into the dentine. Where this dipping arises, the granular layer (*b*, *b*) commonly present at the periphery of the dentine is seen to terminate abruptly.

No. 4 is a transverse section of a three-fanged

Fig. 2.

Fig. 3.

Wyman & Sons. G^t Queen S^t W.C.

lower wisdom stump. Inostosis is seen at two points on the inner wall of the posterior fang, which was curved at a right angle under the ramus of the jaw. A third view of inostosis is seen on the outside of the smaller anterior fang.

Thus augmented, the limited data on which my earlier observations were founded admit of an unlooked-for expansion, chiefly as to the possible extent to which inostosis may penetrate the ivory of the tooth; next, as showing that inostosis may be an effect of the local changes occurring in chronic periostitis, the primary cause not being confined to a crowded condition of the teeth, but may also be due to a diseased condition of the alveolo-dental periosteum *per se;* and, lastly, that "inostosis" is not inseparably coincident with "exostosis," which fact is observable in the penetrating kind; thus the more imperatively claiming a distinct recognition from ordinary exostosis.

The deeper we investigate, the more suggestive this subject becomes of a specific condition of tooth-structure, keeping in view its invariable antecedent "absorption." The evident loss of tissue from this cause, is either indicated by an absence of the dentinal granular layer, or by an obliteration of masses of dentine, its regularly distributed tubuli being cut through abruptly.

In the outline (Fig. 2) the apex of the fang is alone affected by inostosis, and observation thus

far indicates this to be the most frequent situation of this particular pathological condition, due, I apprehend, to the commencement of the effects of inflammation around the dental foramen, and a subsequent destruction of the peridental membrane giving rise to absorption. In the same figure I beg to draw attention to the continuous translucent wavy markings from the dentine into the cementum, as corresponding exactly in character with other shorter festooned lines and rings (*c c*), interspersed in the latter tissue, and to ask whether these may not be consistently traced to the alternate actions of absorption and development attendant on chronic enlargement of the root?

With regard to the osseous systems perforating the crown in many places (Fig. 1):—At first sight, I considered these due to the penetration of caries, which had affected the opposite side of the tooth from which this section was made, and was seen by an aperture just above the neck of the tooth, no portion of the masticating surface having broken through; but a nearer examination showed no disintegration of tissue, or, indeed, any other characteristic mark of dental caries, and proved them to be osseous deposits with a delicate wavy translucent boundary, containing numerous lacunal cells, some with decided canaliculi, but most of them deficient in this respect. (See Fig. 3.) I am persuaded, from the similarity of structure

between these and the cementum of superficial inostosis, that the tissues are identical, both differing alike from secondary dentine, the result of calcification of the pulp, of which a mass is seen in the centre of the crown (Fig. 1, *c*) with its irregular and eccentric formation of dentinal tubuli, continuous with the original tubuli. Calcification of the pulp had proceeded to such an extent, evidenced by a third section of the tooth in my possession, that but a small trace of the pulp-cavity remained. This confirms the idea that the tooth, which I recollect was locked between the necks of two permanent teeth, had been subject to long and protracted chronic irritation. But what is particularly striking, "inostosis" has penetrated the "secondary dentine" itself (see section No. 2), with its wavy translucent line indicating previous absorption: thus, the two differing structures are found in immediate proximity. Furthermore, this osseous structure is partly re-absorbed with the surrounding secondary dentine. At this stage the tooth was extracted. Notwithstanding the presence of vascular canals, there being a total absence of dentinal characteristics, I consider the term "osteo-dentine" equally inapplicable to the penetrating structure under consideration.

Before reducing this tooth to sections, it presented underneath, between what remained of the fangs, a deep, penetrating excavation into the

body of the tooth left by absorption; and I think we may presume that the advancing vascular absorbent organ must have penetrated in the various directions indicated by these osseous systems—the process of absorption was arrested and substituted by one of repair; or, as Mr. Coleman so clearly explained at the December meeting as the latest accepted theory, the absorption was effected by the direct agency of proliferating bone-cells, or osteoblasts, and these may have undergone ossification in the cavities they by absorption had created.

If our investigations tend to prove that this process of osseous penetration was preceded by absorption, and may extend into any part of the ivory of the tooth, may not this peculiar condition of tooth be simply and comprehensively understood by the term "Inostosis"? I would suggest, further, that no needless complication would accrue to our recognising the external and internal kinds of inostosis as "superficial" and "penetrating."

True "superficial inostosis" may be readily distinguished from an apparent intrusion of the cementum into depressions of malformed teeth; for in these cases we find the presence of the granular layer persistent at the periphery of the dentine, and the direction of the dentinal tubuli corresponds with the irregular formation of the tooth, just in the same manner as the tubuli

are seen to deviate from a direct course for the accommodation of a vascular canal occasionally found permeating the dentine.

Figure 3 is an enlarged view of two or three of the osseous systems in illustration of the penetrating kind of inostosis seen in section No. 1. The direct course of the tubuli cut through by absorption, is well shown. I must, however, mention, that wishing to improve the specimen, in remounting it some of the cells became obliterated by balsam, so spoiling the accuracy of a careful representation; but the general characters remaining the same, I did not consider a fresh drawing necessary.

In conclusion, I would remark that it still appears to me favourable to a simple classification, to regard "inostosis" as a variety of the hypertrophied growth known as "dental exostosis": position only, due to penetration by absorption, altering the general character of the ossific deposit as an external enlargement; and lastly, the deposit of this variety presents itself rather as a tissue of repair than as a morbid enlargement, although the two conditions may be seen in one and the same specimen, as in sections 3 and 4.

I have felt considerable diffidence in offering these remarks on what has appeared to me a new aspect of an old subject, but this fact has influenced me in contributing them with a desire to pave the way for a ready recognition of a certain condition

of tooth, which, I am persuaded, is not so infrequent as at first thought to be, also with a view to gaining information myself from an interchange of ideas on the subject.

Our late esteemed President's appreciation of the subject, as one capable of being profitably worked out, certainly encouraged me in a successful search for specimens, and I am sanguine that a perusal of my recent paper, with these additional observations, may modify the views of any member who at first may have considered the term "inostosis" inapplicable to the pathological condition described.

Discussion.

The President invited discussion on Mr. Henry's paper, which he characterized as masterly and suggestive.

No Member, however, offering any remark,

The President said the paper laboured under a considerable disadvantage in the absence of diagrams, which, no doubt, would have rendered it still more intelligible. He was much interested in the paper, and thought that, taking into consideration its briefness, it had been treated with great ability. The only course that now remained open to them, was to offer their best thanks to Mr. Henry for his suggestive essay, and to hope it might be more fully gone into on another occasion. He thought there could be no two opinions among them as to its exceeding interest. He had now to offer their best thanks to Mr. T. and Mr. H. Rogers, and Dr. Belisario, for their valuable contributions to the library, and Mr. Drury for his specimen; and Messrs. Graham and Wood for exhibiting their articulating frame. He would also thank Mr. Hutchinson for his contribution to the Museum, and would here express his very high appreciation of the zeal with which Mr. Hutchinson pursued his studies at the Hospital, a sentiment which he was sure would be coincided with by all present.

Dr. Belisario expressed his deep sense of the manner in which his present to the library had been received; and remarked that, in his capacity of trustee to the Sydney Museum, he had very many opportunities of securing objects of interest, which he should be very glad to transmit to the Society, when opportunity afforded. He had intended on his voyage to England to prepare a paper for reading before the Society, but he was sorry to say that the diet on board the vessel was so bad, that he had not been in a sufficiently vigorous nervous condition to do so, but would attempt it on another occasion.

The President said the Odontological Society would hold Dr. Belisario to his promise, and adjourned the Meeting.

GENERAL MONTHLY MEETING,

Monday, May 6, 1872.

THOMAS UNDERWOOD, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

The following gentlemen having signed the obligation book, were admitted Members of the Society :—

Mr. Reid, Edinburgh, and
Mr. Stringfield, Lowestoft.

The following gentleman was nominated for the Membership of the Society :—

Mr. Henry Marsh, 198, Oxford Road, Manchester.

The following gentlemen were duly elected Members of the Society :—

Mr. S. Hamilton Cartwright, M.R.C.S., L.D.S. (Resident).
Mr. John Fairbank, M.R.C.S. (Resident).
Mr. James Osbourne Edwards, Batavia (Non-resident).
Mr. William Caleb Williams, L.D.S., Leamington (Non-resident).

The President announced that the Library was open to the members.

The President also announced the donation of copies of the "British Journal of Dental Science," by Mr. T. Charters White, making that series now complete.

Mr. T. Charters White described an ingenious arrangement he had devised for administering nitrous oxide. In dental cases it enabled the administrator, who was likewise the operator, to have perfect control over the gas-bottle as well as other portions of the apparatus.

The President then called upon Mr. Braine to deliver his lecture upon the "Chemical and Physical Properties of Nitrous Oxide," of which the following is an abstract.

On the Chemistry of Nitrous Oxide Gas. By Mr. F. Woodhouse Braine, F.R.C.S.

Mr. Braine said that when he was first asked to read a paper before the Society by the gentleman who now so ably occupied the presidential chair, he had hoped to comply with that request by laying before the members the results of some original investigations upon the physiological action of nitrous oxide gas. When, however, he came to look more deeply into this question, almost insuperable difficulties arose before him, and he felt the impossibility of carrying out in their presence any experiments which would conclusively show the manner in which nitrous oxide produces insensibility to pain. Desirous still of fulfilling the wish of their President, and of making some return to a Society at whose meetings he had passed many pleasant and profitable evenings, he expressed his willingness to deliver, in the place of a paper, a lecture upon the "Chemical and Physical Properties of Nitrous Oxide;" for, although he could not promise them any new facts or information other than was within their own reach, he felt he might, by a series of experiments, more thoroughly bring home to their minds the chemical and physical

laws of a body now so largely employed by the members of their profession. Having arrived at this conclusion, he was next most fortunate in securing the co-operation of Mr. Wills, who had rendered him the greatest assistance in preparing and arranging the experiments they were to witness.

Mr. Braine then briefly gave the history of the discovery of the gases as elementary bodies, illustrating this subject by a diagram.

The nature of atmospheric air and the properties of nitrogen were fully discussed, and the compounds of the latter with oxygen, as contained in the following table, and the other elementary bodies briefly pointed out :—

COMPOUNDS OF NITROGEN WITH OXYGEN.

	Nitrogen.		Oxygen.
Nitrous oxide	14	...... + ...	8
Nitric oxide	14	...... + ...	16
Nitrous acid	14	...... + ...	24
Hypo-nitric acid	14	...... + ...	32
Nitric acid	14	...... + ...	40

Nitrous oxide, the first on the list, and the subject of his lecture, was discovered by Priestley in 1776, and more carefully examined by Sir H. Davy in 1809. It is composed of two volumes of nitrogen united with one volume of oxygen, but condensed into the space of two volumes (these volumes being represented by the lecturer

in wooden blocks, occupying a litre and two-litre measures). This was experimentally shown by passing a rapid series of electric sparks through the gas, when an increase in its bulk was noticed. Two processes for its preparation were given, viz. :—

1. By heating nitrate of ammonia, which was entirely split up into nitrous oxide and water, thus—

Nitrate of Ammonia.		Nitrous Oxide.		Water.
NH_4NO_3	$=$	N_2O	$+$	$2H_2O$

The precautions necessary in preparing nitrous oxide by this method were mentioned.

2. By acting on zinc with very dilute nitric acid, in which case the acid was reduced at the expense of the zinc. The gas collected over cold water suffered a certain loss by absorption by that fluid, and this was experimentally shown to be 1·30 volumes of nitrous oxide to one volume of water.

Nitrous oxide did not support combustion, but as it was decomposed by a combustible body in a heated state, afforded by its liberated oxygen the means of supporting combustion. Feebly-burning sulphur was shown to be extinguished when immersed into a jar of the gas, but burning phosphorus and incandescent wood, being of a higher temperature, burned in the gas with great splendour. For the same reason the gas would not support animal life, but it might be breathed

for a short time, as first shown by Davy, producing a stimulating effect upon the system: hence its name laughing gas.

Mr. Braine then proceeded to speak of the physical properties of nitrous oxide. As regarded its specific gravity, that was much greater than air, in the proportions of 1·53 to 1. This fact was shown by a variety of experiments; thus, the gas was poured from a vessel full of it into one containing air, which by its greater density it displaced; it was baled out of a vessel into one containing air, and displaced the latter; it was drawn off from a vessel into another by a siphon; and, lastly, it was drawn off from a vessel by a tap, just as a liquid would be.

Nitrous oxide was not a permanent gas, that is, it did not remain gaseous under extreme pressure, for then it assumed the liquid form. This probably would apply to all gases, had we the means of carrying their compression sufficiently far; but, be this as it might, there were at the present time five gases which had resisted all efforts to bring them into the liquid condition: viz., oxygen, nitrogen, hydrogen, carbonic oxide, and nitric oxide. Gases might be looked upon as the unsaturated vapours of liquids having their boiling-points far below any ordinary temperatures: as these boiling-points are approached, they become more and more nearly saturated, till at last a point is reached at which further reduction of

temperature or increase of pressure will cause a condensation of some portion of them to the liquid state.

To illustrate this, we might refer to the case of ordinary water-gas or steam. At the boiling-point of water a vapour is given off, and so long as this vapour is kept above the boiling temperature, it exhibits the properties of a true gas; but the moment that the heat falls below this point, or what comes to the same thing, if external pressure be applied, a portion or the whole of the steam returns to the liquid state. With respect to water this might be rendered perfectly evident, but with other bodies having much lower boiling-points, extreme pressure and great cold had been applied to obtain their condensation to the liquid state.

Ether, the boiling-point of which was about 100° Fahr., was liquefied by the pressure of one atmosphere (in excess of the ordinary atmospheric pressure) at ordinary temperatures.

Sulphurous acid gas	required	4	atmospheres,	or	60 lb.	per sq. in.
Cyanogen	,,	6	,,		90	,,
Ammonia	,,	8	,,		120	,,
Carbonic acid gas	,,	36	,,		540	,,
Nitrous oxide gas	,,	40	,,		600	,,

The means by which Faraday effected the liquefaction of nitrous oxide was shown to the meeting.

The boiling-point of liquid nitrous oxide was —125° Fahr.

Through the kindness of Mr. Samuel Coxeter he had the loan of a vessel containing 1,000 gallons of the liquid gas. The condensing-pumps which were used for liquefying the gas were exhibited; the Messrs. Coxeter employed steam-power for working them; the heat evolved during the condensation of the gas was absorbed by ice, which surrounded the receivers. No gas had as yet been solidified by direct pressure, but this had been in many cases effected by cold. Frozen carbonic acid presented the appearance of a snow-like mass passing directly into the gaseous state without becoming fluid; nitrous oxide differed from carbonic acid in that it could only be solidified with the greatest difficulty, and when frozen presented the appearance of a glassy mass. This solidification of the gas was first effected by Mr. Wills last year.

The following experiments were then exhibited. A beaker glass was placed upon a wet stool, into the beaker some gas was directed from the 1,000-gallon vessel, and the beaker was so firmly frozen to the stool that the latter could be lifted up by it; into a blackened glass globe a stream of the liquid was directed, when presently the outer surface of the globe was seen to be covered with hoar-frost, the result of condensation, and then freezing of the moisture in the room upon it: a

stream of the gas was directed upon some mercury in a glass flask, when the latter became solidified; the lecturer hammered it to show its solidity; he then placed the mercury in some water, when the mercury melted, and the water froze. By an arrangement devised by Mr. Wills, liquid nitrous oxide, a clear mobile liquid of slight refractive power, was collected and exhibited; an iron rod dipped into the liquid caused it to boil; water dropped on to it was instantly converted into vapour with explosive violence; ignited charcoal placed upon the surface of the liquid floated about, burning vividly, the explanation of this being that the liquid was in the spheroidal condition, and surrounded by a stratum of gas which prevented the ignited mass from coming into contact with it. When bisulphide of carbon was mixed with liquid nitrous oxide, the lowest temperature ever produced was attained, viz. 220° below zero, at which temperature alcohol, though not frozen, became so viscid that the vessel containing it might be inverted without its contents falling out of it. In conclusion, the lecturer thanked the members for their kind attention, and again expressed his regret at not having been able to bring before them the physiological action of nitrous oxide in annihilating pain; but he thought, before this could be satisfactorily done, we must be better informed as to the manner in which sensations are transmitted

along nervous cords: he ventured to think this would be proved to be by undulations, and that, as in the case of light, where two luminous waves by interfering with each other produced darkness, or two sonorous waves by like action produced an interval of silence, so might the undulations caused by anæsthetics interfere with those produced in nerves by the surgeon's knife as to give our suffering fellow-beings immunity from pain.

Discussion.

Mr. Coleman said that, whilst it would be out of place to attempt to discuss the facts brought before them that evening by Mr. Braine in his lecture, he should like, in the capacity of a member, to express his obligations to that gentleman for the vast amount of trouble, and when he looked at the costly array of apparatus before them he might also add expense, he had put himself to on their behalf. They could not be too familiar with those chemical and physical properties of nitrous oxide which, by a series of interesting and most successful experiments, had been brought home to their minds that evening; and he fully agreed with the lecturer, that before attempting to explain the physiological properties of nitrous oxide, a thorough knowledge of its chemical and physical properties was necessary. Many of the experiments they had witnessed, though not original, had been seldom made, but some had, he understood, never been performed in public before.

The President said he was sure they would all unite with him when he conveyed the best thanks of the meeting to Mr. Braine for his deeply interesting and charmingly illustrated lecture.

Mr. Braine having responded, the President adjourned the Society to the 3rd of June, when a Paper will be read by Mr. Makins, M.R.C.S , F.C.S., "On the Welding of Metals."

GENERAL MONTHLY MEETING,

Monday, June 3, 1872.

THOMAS UNDERWOOD, Esq., President, in the Chair.

The Minutes of the last Meeting were read and confirmed.

Mr. John Fairbank, M.R.C.S., having signed the obligation book, was admitted a member of the Society.

The following gentleman was elected a resident member of the Society :—

Mr. Thomas Percy, Montagu Street, Portman Square.

The President announced the following donations to the Society :—

From Mr. Edey, of Brisbane, a box of anatomical preparations; and from Dr. Falk, the Transactions of the Berlin Medical Society.

Mr. Howard Kyan exhibited a model of the mouth of a youth, aged 12, in which were three supernumerary teeth.

Mr. Fairbank.—Believing it to be generally understood that, unless the nerve-pulp be exposed and protected from pressure, the application of arsenic will give great pain, I beg to lay before the Society a form of cap for protecting the nerve from pressure during its destruction by arsenic. This cap admits of the application of the arsenical paste, and of the cap at the same time, with great precision and little trouble. It is made of sheet lead, and is pierced in the centre by a small hole. In preparing it for use, you roll up a small piece of cotton into a sort of triangular ball, the apex being long and pointed; the pointed end you push through the hole with a fine instrument, pulling it afterwards well through with a pair of plugging tweezers. The thin portion of cotton on the one side of the cap now serves

as a handle, while the other portion, on the concave side of the cap, serves for the application of the arsenic. When about to apply it, you seize the thin handle of cotton with your tweezers, and having put the arsenical paste on the cotton contained in the cup of the cap, smear the edges of the cap with gum sandarac, and place it in the tooth *in situ*. You then fill in with wax or Hill's stopping. The hole is so small that it does not in the slightest degree impair the protecting power of the cap.

I beg also to present to your notice a swivel, so made as to contain within its head the stop, thus doing away with the so-often adopted but objectional method of screwing in a wire stop. There are three forms of this modified swivel: in the first, the head of the pin stops the swivel; in the second, the pin stops the swivel; and in the third, which I think the best, the escutcheon or groove cut in the vulcanite stops the swivel. They are not at all complicated, and if approved of by the profession, could, I should think, be manufactured at almost the same rate as the ordinary swivel. They possess none of the disadvantages of the old form of stop—viz., irritating or pinching the cheek, tilting out the swivel, &c.

Mr. Oakley Coles brought forward a somewhat singular case of retarded dentition in a boy thirteen years of age, in which only the two upper central incisors had been erupted and the right lower molar. The upper permanent incisors had been preceded by two temporary incisors, but no other temporary teeth had ever appeared. There was no history of inherited or severe infantile disease.

The President asked Mr. Coles what mode of treatment he had tried in this case.

Mr. Coles.—The treatment adopted was supplying a plate for the lower jaw to assist him in mastication, which he accomplished with his upper incisors. The boy had all the appearance of premature old age, his nose and chin nearly meeting.

Mr. Perkins exhibited a small pneumatic bracket designed ostensibly for a music-stand, but which he had adapted to dental purposes. It could be easily attached to the tops of mantlepieces, &c., and was as easily removable.

Mr. Kirby.—In order to verify and extend the experiments which have lately been made with amalgams, I have had an apparatus made for measuring the changes of bulk, which take place during and after their hardening. It consists of a V-shaped trough with sides at right angles to one another; one end is fixed, the other slides freely backwards and forwards, and has a micrometer-screw in contact with its outer side. If a mass of amalgam is carefully packed into the trough whilst the screw is clamped at zero, and the clamp be then removed and the screw withdrawn, both expansion and contraction can take place freely, and their extent may be measured (as soon as the substance is hard enough to resist compression) to $\frac{1}{10,000}$ of the diameter of the mass. The resulting bar of metal can be turned out of the trough and remeasured at any interval of time. Measured by these means, it appears that, as has been stated, many of the amalgams in use contract during setting, and further, that change in form as well bulk takes place in all when they are used in the hard state, which has been recommended. These changes often continue for days, or even weeks. Amalagam of pure silver, either in the form of precipitate or of filings, expands greatly, the former to the extent of $\frac{1}{40}$ diameter, or more. Silver filings, after being made into an amalgam and allowed to set, change their surface from a smooth to a nodulated one, from gradual absorption of the mercury by the granules of uncombined silver. Mixtures of silver and tin with more than one equivalent of the latter, contract to a great extent, the contraction lessening as the silver is increased, until with three equivalents of silver to two of tin an amalgam is formed with one equivalent of mercury, which, after some contraction, finally expands slightly about $\frac{1}{500}$. A mixture of two equivalents silver, one tin, and about 25 per cent. gold expands without any contraction. Amalgams rich in silver set very rapidly, but appear to give the best results when the metals are in equivalent proportions, the forms given by Mr. Tomes, sen., and Dr. Roberts being more uncertain than similar mixtures in exact equivalents. The quantity of mercury also greatly influences the expansion, but has another and even more important effect, for a plug made of hard amalgam changes its shape greatly, continuing to do so for some days;

U 2

some bars so made could not be measured again in the course of a few hours from this cause. This effect is also visible if hard amalgam is carefully condensed in a glass tube, and when set immersed in a coloured solution contained in a chamber from which the air can be exhausted. On re-admitting the air, the colour is found to have penetrated into the part last packed, an effect not produced if the amalgam is formed with an equivalent of mercury, which makes a very soft paste when mixed with filings of three equivalents silver to two tin, or two silver to one tin. The equivalent of mercury is in either case nearly twice the weight of the mixed metals, and if the last portion of the stopping is squeezed dry, and the surface of the amalgam further freed from mercury by applying to it a lump of very dry paste, the last part of the filling so made will expand more than the first by abstracting mercury from it. In reference to the danger of an expansive stopping splitting a tooth, some glass tubes filled with silver amalgam were split open by it, but, in other cases, the amalgam protruded considerably from the orifice without splitting them, the protrusion increasing long after perfect hardening had taken place. If, therefore, an expansion of 1 in 40 does not always split a frail tube, there is not much fear of those proposed with 1 in 400 expansion. In reference to colour, I have applied no tests, as that is not important in the class of cavities for which amalgam should be used; but when it is desirable to use it near the front of the mouth, I have found a lining of gold-foil with Ash's filing prevent discolouration for six years, which is the length of time I have used it. In order not to neglect Sullivan's and the copper amalgams, it should be stated that they show contraction commencing with $\frac{1}{2000}$ at five hours in one case, increasing to $\frac{1}{1000}$, or in some cases more. I may mention that within a few days I have seen in a lower second molar of the right side an amalgam stopping of large size, introduced by Mr. Cartwright more than twenty years ago, and still good. It would be interesting to learn its composition.

On the Union of Metals by Welding.

By G. A. Makins, Esq.

Mr. President and Gentlemen,—

In the short paper which I have prepared for this evening, upon union of metals by welding, I have endeavoured to put before you a few known facts in such a manner as, I venture to hope, may call forth interest in them, and thus probably bring out such analogous points as may have presented themselves to some of the gentlemen present in the course of their daily practice, and that I may thus induce useful discussion.

Let me first remind you, that when we speak of welding a metal, we mean the bringing about of as intimate contact in the particles at the welded part as exists in the separate portions of metal themselves; so that, when compactly welded, they form one uniform mass, as sound as if originally wrought in one only.

Now, as iron admits of such union perhaps more perfectly than any other metal, let us briefly review the steps required for effecting it, and also the precautions needed.

The two portions to be so joined are first heated until the surfaces are rendered quite soft and plas-

tic. Iron is one of the metals in which this soft condition is only obtained by subjecting it to a very high temperature, and the difficulty which arises in all metals which require great heat for this object is, that before welding softness is arrived at, they suddenly pass from the solid condition to fusion, and thus all shape or form is destroyed.

Iron, however, is peculiar in passing through a pasty state, before actual fusion can occur, and this state continues through a considerable range of temperature; in this, the metal remains amply hard enough to retain its form, although its particles are so soft and mobile that they can easily be pressed into close contact for the welding.

But as at the temperature needed for bringing about this soft and pasty condition, the affinity of the metal for oxygen is very considerably heightened, its surface becomes covered with a thin pellicle of oxide; such indeed, as effectually prevents metallic contact, and hinders union. The workman therefore sprinkles some sand or silica over the heated parts; this, at the high temperature, will act as an acid towards the oxide of iron, which latter combines as a base with the silica, and a very fluid ferrous silicate results, which varnishes the surfaces of the metal, and thus preserves them from further contact with the oxidizing air. Then, on bringing the pieces together and subjecting them to the hammer, in order now

to bring about union, this saline varnish (quite fluid at the heat employed) is squeezed or rather driven out, and the metal brought into intimate contact is readily and perfectly welded.

Now the two chief essentials in all such operations are here well shown. The first, a considerable degree of softness; for the metal must be soft enough to allow of yielding sufficiently to pressure, so as to admit of its being squeezed fairly into contact.

The second, perfect cleanliness of surface, so that the contact may be actual, and not interfered with by any interposed matter.

I may now pass some other metals under review, and with the above conditions borne in mind; and first, such as require elevated temperature for softening.

Platinum, then, admits of as perfect welding as iron; but in the manufactured metal, the requisite softness is not to be attained below a dull red heat, and for very perfect welding, nearly a white heat is needful.

This is not surprising when we consider the extreme infusibility of this metal, and consequent very high temperature required entirely to liquefy it. I may remark that unlike iron it passes very suddenly to fluidity. Then, although its surface is most difficult of oxidation, it must nevertheless be rendered bright and clean; but for this it should be brightened by means of the edge of a

file, so as to leave a rough, bright surface, for a polished platinum surface will not weld either easily or perfectly. After thus cleaning and heating, short, sharp blows are to be given with the hammer, guarding carefully against any extension of the metal, before actual union can be effected. With these precautions a perfect weld is got, and without much alteration of shape.

The capability of manufacturing platinum by Wollaston's method entirely hangs upon this welding property, and the contact of metallic particles ensured in manufactured metal by heating to soften them, is in his process got by using the metal cold, but in the spongy or pulverulent condition in which he precipitates it, for you will remember that after solution of the metal or ore in acid, he separates the platinum again as a double chloride by adding ammonic chloride (sal ammoniac), and on heating this double salt drives all off but the metal, which by this treatment is left in a perfectly spongy condition. But here, as in ingot or sheet platinum, in order to insure a good weld, the surface of the particles of broken-up sponge must not be polished or burnished—they are carefully maintained in a roughened condition, when partial welding may be effected by simple pressure, *and at ordinary temperatures;* and although I say partial, it is really true welding, but with interstitial spaces, and hence the amount of solidification thus effected so much hardens it,

and its surface especially, that for complete condensation it must be heated and hammered. And this statement is verified by the fact that the specific gravity of the cake as first obtained by cold pressure, is not quite half that of the finally forged metal, being in fact about 10·5 as compared with 21·5.

Contact of particles brought about by the pulverulent condition thus lowers the temperature needed, and indeed often admits of welding in those which would not otherwise allow of it. Thus, if copper is reduced in a state of fine division, and is kept clean, that is to say, free from oxidation, it will adhere under moderate pressure, so that if squeezed into a mould a compact partially welded cake will result. It would be impossible to heat such a metallic powder for welding without entire oxidation unless thus first partially welded. But having by this condensation diminished the amount of surface for air contact, it may then be quite safely heated, and thus further shrunk, after which welding may be quite perfected by pressure or by the hammer.

I think we may assume that the object of heating, in all cases, is merely to render the metallic particles sufficiently soft and mobile to allow of their being brought into actual close contact, and therefore, where a metal is naturally soft at ordinary temperatures, welding may be performed at such. Thus in the case of two portions of lead,

if we cut or file their surfaces clean and then press them together with a slight twisting motion, they will cohere, uniting more or less perfectly according to the pressure used. For in this case we have a metal which is naturally soft at ordinary temperatures, and hence if united immediately on cleaning the surface adhesion will be perfect. I say immediately, because lead is one of a class wherein atmospheric oxidation commences the very moment a clean surface is exposed to the air.

But not only may pieces of the same metal be united under such proper conditions, but we may also effect union between pieces of different metals, if they possess about similar degrees of softness.

Thus a clean surface of lead will unite with a similarly clean one of tin under very moderate pressure.

Now, here we may, I think, look at the case of Amalgams. For in forming an amalgam we employ the already fluid metal mercury simply as a solvent or softener of solid ones; in fact, we put the solvent power of mercury in place of that of heat, but with the attendant disadvantage of being compelled to retain the solvent after its actual service is no longer needed.

I apprehend that for your special use as a plugging material, an amalgam must be valuable just to the extent to which you can ensure the

solid element being sufficiently soft without being obliged to employ any great excess of mercury—or it will be equally so where you can produce a true chemical combination, as in some few cases you may, and I believe the Palladium amalgam to be one of the latter, as evidenced especially by the heat manifested during combination, and also by the fact that we cannot drive off the mercury much below a white heat. Now with palladium amalgam the time at which chemical combination is actually taking place must be seized for its use, for chemical action once complete, it becomes a hard unworkable mass, and even pulverulent if the palladium is in excess. And this remark holds good of silver amalgams also, but in these chemical combination is very slow in being effected. On mixing reduced silver and mercury you get a crackling paste, and in this condition it may be preserved, but it will at the same time remain too soft for use. If, however, it is gently heated, or so exposed that the excess of mercury may evaporate, you get definite chemical compounds left, but the amalgam will have shrunk and become hard, harsh, often crystalline, and entirely without plasticity.

Amalgams as a rule are composed of a metal with mercury, which compound is further dissolved in an excess of mercury, and although, when subjected to pressure, this excess is largely squeezed out, as in large ore operations for gold

or silver separating, yet it is very difficult to do this to such an extent as that no free mercury is retained. And indeed by much the same action as when one squeezes a sponge containing a fluid, you get the mercury forced to the whole surface, and thus, in your operations, what is so forced between the sides of the cavity and the plug, by slow and gradual vapour exhalation, is liable to leave a minute interspace.

I have generally expressed pretty much these same opinions in my lectures to the students in this place.

But I have just read with much pleasure the excellent paper read to you by my colleague Mr. TOMES, and although I cannot quite agree with him on all points, I am satisfied that he is working in the right direction, and doing good service in the matter, and hope he will continue his experiments, so as to bring a vexed question to a satisfactory solution.

But the question as to how far this welding property is possessed by the metals you employ in plugging operations is, I imagine, the one of interest to you. Now pure gold and silver belong like platinum to a division of metals which are unaffected by atmospheric oxidation, and hence are controlled only by the question of softness and adhesive qualities. Now, in gold especially, these are so perfect, that in fine division, it may be more or less perfectly welded when cold, and

soundly, if heated to a very low annealing temperature.

Pulverulent or precipitated silver may also be thus welded, although its softness not being equal to that of gold, more precaution is needed to effect it. I have done it readily in a mould on the principle of Wollaston's platinum welding apparatus, and similarly the cake so formed may be perfectly forged by moderate heating.

Again, if we mix pulverulent silver and gold, and so weld them, good union may be brought about, and a variegated or damasked cake will result. Tournet states that at the point of contact, the metals actually alloy, and that large masses may be welded, by pressure or by hammering into a mould for the purpose.

I have upon the table for your examination specimens of silver so welded from this precipitated metal. The first, done cold, and by very gentle hammering, forms as you will see a compact cake, which we may compare with Wollaston's first product of platinum.

The specific gravity of this is 5·9 (melted fine silver being you will remember 10·53). In the second specimen, containing just the same weight of silver after treatment cold, the button has been annealed in a porcelain crucible, and at a heat much below redness, and then again hammered. Thus the specific gravity is raised to 6·3, and might be increased in proportion to

the increased heat for annealing and forging given to it.

The third is a specimen of about equal proportions of gold and silver, which here is fairly welded; and in proof of what I have asserted as to the necessity of an unpolished surface, I may show this fourth specimen, where in carelessly mixing the two metals a considerable portion became burnished, and the result was that it was impossible to weld them, the mass breaking up under pressure of the hammer, indeed light hammering would completely powder the mixture.

Gold for your use is produced as you know but in two forms. First the various ones of precipitated gold, sold as sponge gold, from its texture and nature, and secondly the ordinary form of beaten foil, which is often further treated by some mechanical treatment, or by heat, so as to render its surface yet more adhesive, or fit for welding.

We may prepare precipitated gold in a condition which admits of most complete union, but, to ensure such fit metal, the precipitation must be effected by some decomposing agent, capable of depositing the gold without at the same time contaminating it with other bodies; for in some cases we may even get solid matter down with it, and, if not actually so, such as will much interfere with its molecular condition.

For instance, if in a solution of auric terchloride, that is, a solution of gold in ordinary aqua regia,

we place a piece of one of the lower metals—bismuth, lead, zinc, or cadmium, for example—we get metallic gold down as a brown powder, as here shown; but inasmuch as in all these instances we replace each atom of gold removed from the solution by an atom of the precipitating metal, in combination with the second element of the gold salt,—and again, in some cases this new compound may not be very soluble, it will much contaminate the precipitated gold, and hinder the formation of a coherent precipitate. And, indeed, in cases where the new chloride is very soluble, as in the zinc or cadmium chlorides, their very solubility renders them equally injurious to the precipitate by saturating it with a dense metallic solution. Hence a very powdery gold results, and such a form as can only be welded with difficulty. Now, very analogous to these is the gold precipitated when we add ferrous sulphate to auric terchloride.

Ordinary sulphate of iron, or ferrous sulphate, is in itself sufficiently soluble, but its action here depends upon its abstraction of the chlorine of the gold salt, and its own consequent conversion partly into ferric chloride, and partly into ferric sulphate, the former a very soluble, (and if I may use the term) penetrating salt, and the latter a rather insoluble one. Hence, the orange-brown gold so obtained is more or less pulverulent, very non-adherent, and, indeed, to weld at all, requires

careful heating and hammering. Again, in this case, the newly-formed iron compounds are so adherent to the gold, that we can only free it from them by several boilings with hydrochloric acid; but by this we at the same time alter, in some degree, the mechanical texture of the gold, and bring it nearer in form to some others I am just about mentioning, while with this change, its welding capability will be increased somewhat; proving, I think, the statement I have made as to the effect of the bodies produced during the decomposition upon the desired product.

But in employing such bodies as oxalic or sulphurous acids as reducers, and I take the first more particularly as typical of a large class of organic precipitants, we introduce, in the first, an acid which is very soluble in water, and by the agency of which the gold is separated from its chloride entirely by conversion of a portion of the solution of oxalic acid into a gaseous body, viz., carbonic acid; and in the second case, viz., where we reduce by sulphurous acid, we merely add a gas dissolved in, or absorbed by water, and during the action of this, it is converted into an equally liquid body—sulphuric acid.

Hence, from both of these re-agents we get a more or less spongy mass of gold down, and from the former particularly so, for the reduced metal builds itself up round the streams of gas bubbles, which are continuously evolved from

points of the sides of the vessel in which the operation is carried on, and I can presently show you by the microscope the commencement of the action. In both, however, the resulting metal varies much in molecular condition. Sometimes it will be highly crystalline, exhibiting under the microscope beautifully-formed tetrahedra and octohedra; at others it will build itself up into a clean sheet of foil, with a smooth surface touching the sides of the precipitating vessel, and then a very crystalline reverse, or inner side; at other times it will aggregate into a mass, looking as much as possible like an ordinary sponge, but here again the microscope shows it to be studded with adherent crystals.

Our President may probably recall to mind, as an example, such a piece which I made for him some time since. It formed one spongy mass of about the size of a small apple, and contained near upon an ounce of gold.

Lastly, it will often assume a thick sheety form away from close contact with the sides of the vessel, and in such the one side is generally granular and the other crystalline.

The gold reduced by sulphurous acid holds a place as to this spongy condition between that of the purified metal from ferrous sulphate and that precipitated, or rather reduced, by oxalic acid.

Now, I confess there is yet much to be learned as to the methods of controlling these forms;

they will vary with the dilution of the solutions, again with their temperature, again whether the gold solution is added to the precipitant, or the precipitant to the gold, and even according to the form or shape of the precipitating vessel.

But now, as to the welding property of these. In the case of oxalic acid gold, it is perfect. If we take a piece of this, and work upon it with a burnisher, or gently hammer it, even in the cold, we get a compact cake. But when we are able to go beyond this and warm it (and I use the word warm to express the low temperature needed), we drive off air, and also oxalic acid (if not previously quite washed away, as this acid is volatile at about 350°), and we can then readily obtain a metallic cake. I have frequently shown to my class here a shirt stud, or button, which I have almost constantly worn for some thirteen or more years. It is merely a piece of this gold, first gently hammered into a cake, and then, by warming and burnishing, condensed into a perfectly solid mass, which has withstood the wear of the number of years I state.

Now, this solid welding is due not only to the soft yielding nature of the metallic particles, which are at the same time tolerably tenacious and cohesive in the way they are built up; but it is also largely assisted by the partly granular and partly crystalline condition of the metal, whereby, I believe, a locking together, or kind of dove-

tailing, occurs. Indeed, reduced silver is not, as at first sight it would appear, simply a sandy powder. It is highly crystalline, as I will show you by the microscope, the crystals varying in size, however, dependent upon the rate of reduction and quantity reduced at an operation.

Of course in plugging by any of these forms of gold, such as I am describing, or again, by the peculiar form sent here from America, the operator has not the advantage of being able to use compression upon a solid surface, such as I could employ under the metal in my stud welding operation. Indeed, in all these operations, whether using leaf or sponge, he is working in an irregular cavity, which has comparatively soft and elastic sides. And hence solidity of the inner portions of the mass is not easily ensured.

There is one point, however, of great importance in securing solid welding by sponge metal, and that is not to use any great, but rather very moderate pressure at first, or the action will be so much at the surface as to impede the welding of the centre. The endeavour should be to get union started in the centre, or lower part of the mass, if possible, and this effected, the surface is an easy matter.

For dental leaf, I believe one of the first requisites to be purity of the metal beaten; and impurity, in its power of influencing molecular arrangement in metals, is not to be measured by

quantity of the foreign one, for mere traces of some will entirely change characteristic properties of others.

Thus we have seen that lead and gold are both separately readily welded; but if you contaminate gold with the merest trace of lead you destroy all welding power, and render the previously soft metal brittle in the extreme.

I have frequently examined specimens of your leaf-gold, and commonly found them very pure, a trace of silver being often with them. This was the case with two specimens just given me,—one by our President, and a second by Mr. H. Harding. Indeed, from the pure character of some specimens of foil I have formerly examined, I can only suppose that the metal refined for them must have been done in the wet way of the laboratory by solution and reprecipitation. For the process usual in refining on the large scale here has, until a few years since, been by nitric acid, and the resulting gold will contain at least a grain of silver to the ounce. And again, the sulphuric acid process now in use in some refineries, although it is capable of producing a finer metal as to silver, is yet liable to give one far less fit for beating.

The surface obtained, too, is not a smoothed one, and far from polished; when examined by the microscope it will be seen to be covered with corrugations, with corresponding depressions.

The upper edges of these appear burnished, but the depressions with which the greater part of the surface is covered are perfectly matted; and this is particularly the case in what is sold as adhesive foil, which is far more matted, and of the brown colour which, in precipitated gold, denotes but slight condensation of the metal. Now, if you will recall what I have already stated as to the necessity of such a rough surface as shown in the large operation of platinum welding, you will see that in such leaf-gold we have much the surface needed, and in adhesive foil we have also many of the conditions of sponge gold. Then, further, the advantage possessed by leaf-gold of continuity, so that by convolution, and partial preparation out of the mouth, condensation is really commenced, and I should imagine that much of the work in the cavity consists in squeezing the metal into its irregularity and into the undercutting needful to retain the plug, this manipulation tending at the same time to weld the metal in some degree before final condensation. I speak with much hesitation upon so practical a subject before such an audience as yourselves, as I also do upon the question of the state of the leaf metal in a finished operation. But I do not think it is more than partially welded, and that its cohesion depends much upon the continuous condition of the metal used. And the union is no doubt most perfect just in the

part where solidity is most needed, viz. at the exposed surface, which has been most under the action of the compressing instrument. If the condition of the gold, and the capability of operating, were all that could be desired, you ought to be able to introduce a plug in two separate portions, and render the weld between them as sound as that in the centre of each separate piece, but this is not so; at any rate, in a specimen so manipulated for me a few weeks since I have just examined this by breaking away the sides of the cavity; and although done very carefully, the two portions separated completely at the junction, no actual union having been effected.

Now of the several conditions tending to hinder sound union, in leaf and other gold, the following are the chief I think.

First a hard, or harsh condition of texture, which often spontaneously arises in them if stored for any length of time. In many metals, and in alloys more particularly, such change of molecular arrangement is not at all uncommon. Thus brass is very apt to become crystalline in texture, so that stout brass wire, for example, whose first condition was essentially fibrous, will become so crystalline, that it is rendered more brittle than glass.

Again, such molecular changes in iron are perfectly familiar to engineers, and to such causes

may often be traced fracture in iron beams, axles, &c. Now gold, and more especially the precipitated forms, are very prone to some such change, I do not mean to crystalline form, for that it already has, but some change, after which welding becomes very difficult in it.

A second great hindrance is soling the metal in any way, for although actual oxidation does not take place, yet other adherent matters will quite hinder contact; and moisture, or even air itself, may be thus hurtful. Indeed, the amount of adhesion possessed by air to smooth surfaces, is something astonishing. Take glass for instance— Any one attempting to fill a large barometer tube with mercury, would without previous experience suppose that the heavy fluid metal would readily and completely drive out all air, and itself come in closest contact with the sides of the tube. But he will find that the air adheres so obstinately, that between the mercurial column and the tube, an immense number of bubbles will be fixed, which can only be completely got out by heating the tube and boiling the mercury, whose vapour will thus drive them out. Now leaf gold will thus retain air pretty strongly, and a gentle annealing before use will be quite of as much advantage in getting rid of, may I say loosening this, as in its softening effect upon the metal itself. Then as to moisture, the very breathing of a patient tends to fill the pores of so soft a metal

with moisture, for both foil and reduced gold are really in much the same spongy and absorbent condition, when both are in their most favourable state for your uses.

I do not know how far the matters I have endeavoured to put before you may be of interest or not, for I labour under the great disadvantage of not being myself in the actual practice of your profession, and hence want that experience which every day affords you.

But the points I have touched on appeared to me to bear sufficiently on your professional work to warrant my putting them forward in a somewhat connected shape, and I trust I have not unprofitably employed the time and attention you have given to them.

Discussion.

The President hoped the interesting Paper they had just listened to would provoke a good discussion; the subject was full of practical suggestions, and had been most ably treated.

Mr. A. Kirby said he should like to mention a remarkable instance of cold welding. It occurred in a Cornish pumping-engine, the beam of which, falling on two pieces of iron, caused, after a time, the two surfaces of metal to be so perfectly welded together as to be incapable of separation. The case did not directly bear upon the subject they were discussing, but as an instance of cold welding it was interesting. With regard to amalgams, he thought they should use them exceedingly soft; a pasty condition would be the best for adapting a material to the irregular surface of a cavity. If the material were hard, a good impression of the cavity would not be obtained.

Mr. C. S. Tomes said, from the experiments he had made, he was inclined to the conclusion that the less mercury they employed in their amalgams the better. He had recently weighed daily a portion of Sullivan's stopping after it had been rendered soft by heat, and found that it lost weight for a fortnight. A month after he again weighed the sample, and found it had lost weight during that further period.

Mr. A. Kirby considered that the experiments he had described to them that evening fully bore out the correctness of the conclusions he had arrived at respecting the desirability of employing the amalgams in a pasty condition.

Mr. C. S. Tomes admitted the ingenious character of the means employed by Mr. Kirby for ascertaining the expansion or contraction of amalgams, and considered it valuable as showing changes of *form;* but still he thought that the

method of taking the specific gravities of amalgams in their soft and hard conditions less liable to fallacy than the method pursued by Mr. Kirby for determining changes of *bulk*.

Mr. Makins decidedly approved of the plan adopted by Mr. C. S. Tomes of taking the specific gravities, but thought that the experiments should not be conducted with less than 200 grains of each specimen.

Mr. Fairbank asked Mr. Kirby if, according to his theory, amalgams employed in the moist state were not more liable to contract unequally in the cavity of the tooth,—more at the bottom of the cavity than at the surface.

Mr. Kirby thought not, but rather that there would be expansion at the bottom of the cavity, and that in any case the filling, if dried on the surface, would be in contact with every portion of the walls of the cavity.

Mr. Oakley Coles remarked that amalgam fillings which were quite friable in the mortar frequently became quite plastic and homogeneous in the mouth; he presumed this was effected by the greater warmth of the mouth. This fact taught them that it would be advantageous, if employing amalgams in the drier state, to press them into the cavities of the teeth with heated burnishers.

The President, referring to Mr. Makins's statement respecting the amount of silver he had detected in certain specimens of gold-foil, wished to ask him how much he had found.

Mr. Makins.—In some specimens as much as one grain in the ounce. Some of the gold-foil he had experimented upon was very pure, and he thought it must have been precipitated from its solution in nitro-hydrochloric acid.

Mr. Coleman observed that he had understood from the Messrs. Ash that the adhesive and the non-adhesive gold they were now supplying were prepared from metal precipitated from aqua-regia.

Mr. WHITE, having found some specimens of the crinkled gold very adhesive, asked Mr. Makins if he had tested any such specimens.

Mr. MAKINS had, and had found some very pure. He considered that in welding gold-foil care should be taken that at no time a smooth or burnished surface should, before completion, be given to the stopping. In the experiment to which he had referred in his paper, made for him by Mr. Harding, the two portions of metal were wholly disconnected; had the surface of the first been roughened, the second would, no doubt, have adhered to it.

Mr. KIRBY'S experience was different to Mr. Makins upon this subject. Some two months ago he had tried the experiment of welding pieces of gold-foil upon a burnished surface of the same, and had succeeded in building up a mass of gold by burnishing pieces of gold-foil upon each.

Mr. FAIRBANK asked Mr. Makins how far it would be possible to employ an alloy of gold and tin for filling teeth. Tin possessed a tough nature in the form of foil; not so easily torn as gold. A combination might give an alloy possessing this useful property combined with those found in gold.

Mr. MAKINS said it was possible to get a perfectly malleable alloy of gold and tin, but there was always the danger of getting contamination with a third metal, which would destroy this property; the smallest trace of antimony, for instance, would render such an alloy perfectly brittle; it was the third substance that did the mischief.

Mr. HARDING wished to explain that the gold plug which Mr. Makins had been kind enough to examine for him, and to which he had alluded in his Paper, was made out of the mouth, with pellets or balls of Abbey's No. 4 non-adhesive gold foil.

The PRESIDENT then returned, on behalf of the Society, its best thanks to Mr. Makins for his valuable Paper. It had

given rise to much discussion, which had taken almost a conversational form; this he had not checked, because he saw that, from so suggestive a Paper as that they had listened to that evening, more information was to be gained by the asking and answering of various questions. He had also to thank those gentlemen who had otherwise contributed to the Society, viz., Mr. Edey, Dr. Falk, Mr. Kyan, Mr. Fairbank, Mr. Coles, Mr. Perkins, and Mr. Kirby. This was the last meeting of the session, and he adjourned the Society till the first Monday in November, when, he trusted, they might all meet again with renewed strength and in perfect health.

INDEX.

B.

J.

K.

L.

M.

T.

U.

V.

W.

Y.

THE END.

WYMAN AND SONS, PRINTERS, GREAT QUEEN STREET, LONDON, W.C.